# CODE DIVISION MULTIPLEX CELLULAR MOBILE RADIO COMMUNICATION SYSTEM, BASE STATION SELECTION METHOD AND MOBILE STATION SYSTEM


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| **Inventor:** | FURUKAWA HIROSHI |
| **Applicant:** | NIPPON ELECTRIC CO |
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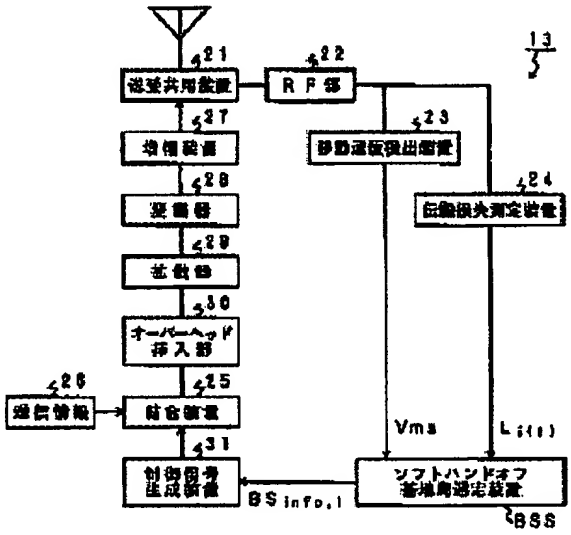
Abstract of **JP11122654**

PROBLEM TO BE SOLVED: To attain communication with base stations of a proper number depending on a propagation environment and a mobile speed of the mobile stations by selecting many more number of connected base stations when a propagation loss level is fluctuated at a high speed and selecting a fewer numbers of connected base stations when fluctuation in the propagation loss is slow. SOLUTION: A transmission signal sent from a base station is received by a reception multicoupler 21 and given to a mobile speed detector 23 and a propagation loss measurement device 24 via an RF section 22. A mobile speed Vms and a propagation loss L1 (t) calculated by the mobile speed detector 23 and the propagation loss measurement device 24 are given to a soft hand-off base station selection device BSS, where a base station being a new soft hand-off object or a measurement whose connection is released is decided. The selection of the base station is attained efficiently with high reliability by changing a base station selection level and a hysteresis margin based on the fluctuation speed of the propagation loss.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The present invention relates to a code division multiplex cellular mobile radio communication system for achieving simultaneous connection between a plurality of base stations, a base station selection method for achieving efficient base station selection and a mobile station system.

An object of the present invention is to achieve effective system management by eliminating excess or deficiency of simultaneous connecting base stations in performing soft hand-off.

[Embodiment]

Hereinafter, an Embodiment of the present invention is explained in detail by referring to attached drawings. Fig. 1 is a view showing a connected state in the soft hand-off of the code division multiplex cellular mobile radio communication system. Figs. 2 and 3 respectively show a mobile station system constituting a mobile station 13 and a base station system constituting base stations 12-1 and 12-2 in the present Embodiment.

An operation of the mobile station system shown in Fig. 2 will now be explained. A transmission signal released by the base station is received at a transmission/reception common device 21 and is inputted to a mobile speed detecting device 23 and transmission loss measuring device 24 after passing through an RF portion 22. The mobile speed $V_{ms}$ of the mobile station is outputted at the mobile speed

detecting device 23. The transmission loss $L_{i(t)}$ [dB] between each of a plurality of base stations adjacent to the mobile station is estimated at the transmission loss measuring device 24. Here, "i" represents a base station index given by an integer between 0 and N, and "t" represents the measurement time. The transmission loss until the plurality of base stations is approximated by for example reception intensity of the pilot signal released by respective base stations and transmission output of the pilot signal. The mobile speed $V_{ms}$ and transmission loss $L_{i(t)}$ is inputted into a soft hand-off base station selecting device BSS, and determines a base station which is to be an object of the soft hand-off or a base station which releases the connection. The result of the determination is given as a connection release parameter $BS_{info.i}$, and $BS_{info.i}$= 1 indicates the connection request to the base station i, $BS_{info.i}$ = -1 indicates the connection release with the base station i, and $BS_{info.i}$ = 0 indicates the sustainment of current connecting state. The connection release parameter $BS_{info.i}$ determined by the soft hand-off base station selecting device BSS is inputted to a control signal generating device 31 and generates a signal the base stations which is required to connect or release. The output of the control signal generating device 31 and transmission information 26 are coupled by a coupling device 25 and additional information is inserted by an overhead insertion 30. The output signal of the overhead insertion 30 is released to the base station by the transmission/reception common device after passing a diffuser 29, modulator 28 and amplifier 27.

The operation of the base station shown in Fig. 3 is explained. The transmission signal released by the mobile station 13

passes the transmission/reception common device 41 and demodulated through an RF portion 42 and demodulator 43. The control signal included in the output of the demodulator 43 is detected at a control signal detecting device 44. The detected control signal is transmitted to a switching station 11, and connection or releasing process of the base station is performed based on the base station connecting command or the base station connection release command included the control signal at the switching station 11.

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1. This document has been translated by computer. So the translation may not reflect the original precisely.

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3. In the drawings, any words are not translated.

[Claim(s)]

[Claim 1] The base station which said mobile station connects by comparing the size of propagation loss RE ** RU from the mobile station in which connection with two or more base stations is possible to said two or more base stations is chosen. In the base station selection approach of sign division multiplex cellular migration communication system of changing the base station which the communication link with two or more base stations is possible for said mobile station to coincidence, and is connected with migration of said mobile station The base station selection approach in the sign division multiplex cellular mobile radio communication system characterized by choosing so that said base station to connect may be increased, and choosing so that said base station to connect may decrease when fluctuation of said propagation loss is slow when changing said propagation loss level at a high speed.

[Claim 2] The base station which said mobile station connects by comparing the size of the propagation loss level from the mobile station in which connection with two or more base stations is possible to said two or more base stations is chosen. In the base station selection approach of sign division multiplex cellular migration communication system of changing the base station which the communication link with two or more base stations is possible for said mobile station to coincidence, and is connected with migration of said mobile station When changing said propagation loss level at a high speed, the hysteresis margin for opting for initiation of connection with a base station and discharge is set up greatly. The base station selection approach in the sign division multiplex cellular mobile radio communication system characterized by setting up said hysteresis margin small when fluctuation of said propagation loss is slow.

[Claim 3] The base station which said mobile station connects by comparing the size of the propagation loss level from the mobile station in which connection with two or more base stations is possible to said base station group is chosen. In the base station selection approach of sign division multiplex cellular migration communication system of changing the base station which the communication link with two or more base stations is possible for said mobile station to coincidence, and is connected with migration of said mobile station The step which grasps each relative propagation loss to said two or more base stations on the basis of the propagation loss of the base station which serves as the minimum propagation loss among the propagation loss to said two or more base stations, The step which asks for the fluctuation velocity of said relative propagation loss, and the step which judges whether each base station and said mobile station connect, When said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds as a result of said judgment ] is less than the threshold

function given as a function of said fluctuation velocity The base station selection approach in the sign division multiplex cellular mobile radio communication system characterized by having the step which starts connection with the base station in connectionless [ corresponding ].
[Claim 4] The base station selection approach in the sign division multiplex cellular mobile radio communication system according to claim 3 characterized by having a step holding a connectionless condition with the base station in connectionless [ corresponding ] when said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds as a result of said judgment ] exceeds said threshold function.
[Claim 5] The base station selection approach in the sign division multiplex cellular mobile radio communication system according to claim 3 characterized by canceling connection with the base station under corresponding connection if said relative propagation loss to the base station under connection which connects and corresponds as a result of said judgment exceeds the level which added the hysteresis margin to said threshold function given as a function of said fluctuation velocity.
[Claim 6] The base station selection approach in the sign division multiplex cellular mobile radio communication system according to claim 3 characterized by to have a step holding a connection condition with the base station under corresponding connection when said relative propagation loss to the base station under connection which connects and corresponds as a result of said judgment does not exceed the level which added the hysteresis margin to said threshold function given as a function of said fluctuation velocity.
[Claim 7] Said threshold function is the base station selection approach in claim 3 characterized by setting up so that it may give with the function which makes an argument fluctuation velocity of said relative propagation loss and may become such a big value that said fluctuation velocity is quick thru/or the sign division multiplex cellular mobile radio communication system of any one publication of six.
[Claim 8] Said hysteresis margin is the base station selection approach in claim 3 characterized by setting up so that it may give with the function which makes an argument fluctuation velocity of said relative propagation loss and may become such a big value that said fluctuation velocity is quick thru/or the sign division multiplex cellular mobile radio communication system of any one publication of six.
[Claim 9] The base station which said mobile station connects by comparing the size of propagation loss RE ** RU from the mobile station in which connection with two or more base stations is possible to said two or more base stations is chosen. In the base station selection approach of sign division multiplex cellular migration communication system of changing the base station which the communication link with two or more base stations is possible for said mobile station to coincidence, and is connected with migration of said mobile station The base station selection approach in the sign division multiplex cellular mobile radio communication system characterized by choosing so that said base station to connect may be increased, and choosing so that said base station to connect may decrease when the passing speed of said mobile station is slow when the passing speed of said mobile station is quick.
[Claim 10] The base station which said mobile station connects by comparing the size of the propagation loss level from the mobile station in which connection with two or more base stations is possible to said two or more base stations is chosen. In the base station selection approach of sign division multiplex cellular migration communication system of changing the base station which the communication link with two or more base stations is possible for said mobile station to coincidence, and is connected with migration of said mobile station When the

passing speed of said mobile station is quick, the hysteresis margin for opting for initiation of connection with said base station and discharge is set up greatly. The base station selection approach in the sign division multiplex cellular mobile radio communication system characterized by setting up said hysteresis margin small when the passing speed of said mobile station is slow.

[Claim 11] The base station which said mobile station connects by comparing the size of the propagation loss level from the mobile station in which connection with two or more base stations is possible to said base station group is chosen. In the base station selection approach of sign division multiplex cellular migration communication system of changing the base station which the communication link with two or more base stations is possible for said mobile station to coincidence, and is connected with migration of said mobile station The step which grasps each relative propagation loss to said two or more base stations on the basis of the propagation loss of the base station which serves as the minimum propagation loss among the propagation loss to said two or more base stations, The step which asks for the fluctuation velocity of said relative propagation loss, and the step which judges whether each base station and said mobile station connect, When said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds as a result of said judgment ] is less than the threshold function given as a function of the passing speed of said mobile station The base station selection approach in the sign division multiplex cellular mobile radio communication system characterized by having the step which starts connection with the base station in connectionless [ corresponding ].

[Claim 12] The base station selection approach in the sign division multiplex cellular mobile radio communication system according to claim 11 characterized by having a step holding a connectionless condition with the base station in connectionless [ corresponding ] when said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds as a result of said judgment ] exceeds said threshold function.

[Claim 13] The base station selection approach in the sign division multiplex cellular mobile radio communication system according to claim 11 characterized by canceling connection with the base station under corresponding connection if said relative propagation loss to the base station under connection which connects and corresponds as a result of said judgment exceeds the level which added the hysteresis margin to said threshold function given as a function of said fluctuation velocity.

[Claim 14] The base station selection approach in the sign division multiplex cellular mobile radio communication system according to claim 11 characterized by to have a step holding a connection condition with the base station under corresponding connection when said relative propagation loss to the base station under connection which connects and corresponds as a result of said judgment does not exceed the level which added the hysteresis margin to said threshold function given as a function of said fluctuation velocity.

[Claim 15] Said threshold function is the base station selection approach in claim 11 characterized by setting up so that it may give with the function which makes passing speed of said mobile station an argument and may become such a big value that said passing speed is quick thru/or the sign division multiplex cellular mobile radio communication system of any one publication of 14.

[Claim 16] Said hysteresis margin is the base station selection approach in claim 11 characterized by setting up so that it may give with the function which makes passing speed of said mobile station an argument and may become such a big value that said passing speed is

quick thru/or the sign division multiplex cellular mobile radio communication system of any one publication of 14.
[Claim 17] The propagation-loss measuring device which measures the propagation loss from said mobile station to said each base station including two or more base stations and at least one mobile station, When connecting with said propagation-loss measuring device and changing said propagation loss level at a high speed, The hysteresis margin for opting for initiation of connection with a base station and discharge is set up greatly. Sign division multiplex cellular mobile radio communication system characterized by having provided the software hand off base station selection equipment which sets up said hysteresis margin small, and being constituted when fluctuation of said propagation loss is slow.
[Claim 18] The propagation-loss measuring device which measures the propagation loss from said mobile station to said each base station including two or more base stations and at least one mobile station, When connecting with said propagation-loss measuring device and changing said propagation loss level at a high speed, The hysteresis margin for opting for initiation of connection with a base station and discharge is set up greatly. When fluctuation of said propagation loss is slow, the software hand off base station selection equipment which sets up said hysteresis margin small is provided. This software hand off base station selection equipment Each relative propagation loss to said two or more base stations is grasped on the basis of the propagation loss of the base station which serves as the minimum propagation loss among the propagation loss to said two or more base stations. Ask for the fluctuation velocity of said relative propagation loss, and it judges whether said each base station and said mobile station connect. When said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds as a result of said judgment ] is less than the threshold function given as a function of said fluctuation velocity Sign division multiplex cellular mobile radio communication system characterized by starting connection with the base station in connectionless [ corresponding ].
[Claim 19] Said threshold function is sign division multiplex cellular mobile radio communication system according to claim 18 characterized by setting up so that it may give with the function which makes an argument fluctuation velocity of said relative propagation loss and may become such a big value that said fluctuation velocity is quick.
[Claim 20] Said software hand off base station selection equipment is sign division multiplex cellular mobile radio communication system according to claim 18 or 19 characterized by holding a connectionless condition with the base station in connectionless [ corresponding ] when said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds as a result of said judgment ] exceeds said threshold function.
[Claim 21] Said software hand off base station selection equipment is sign division multiplex cellular mobile radio communication system according to claim 18 or 19 characterized by to cancel connection with the base station under corresponding connection if said relative propagation loss to the base station under connection which connects and corresponds as a result of said judgment exceeds the level which added the hysteresis margin to said threshold function given as a function of said fluctuation velocity.
[Claim 22] Said software hand off base station selection equipment is sign division multiplex cellular mobile radio communication system according to claim 18 or 19 characterized by to hold a connection condition with the base station under corresponding connection when said relative propagation loss to the base station under connection which connects and corresponds as a result

of said judgment does not exceed the level which added the hysteresis margin to said threshold function given as a function of said fluctuation velocity.
[Claim 23] The propagation-loss measuring device which measures the propagation loss from said mobile station to said each base station including two or more base stations and at least one mobile station, It connects with the passing speed detection equipment which detects the passing speed of said mobile station, and said propagation-loss measuring device and said passing speed detection equipment. When said passing speed is quick, the hysteresis margin for opting for initiation of connection with a base station and discharge is set up greatly. Sign division multiplex cellular mobile radio communication system characterized by having provided the software hand off base station selection equipment which sets up said hysteresis margin small, and being constituted when said passing speed is slow.
[Claim 24] The propagation-loss measuring device which measures the propagation loss from said mobile station to said each base station including two or more base stations and at least one mobile station, It connects with the passing speed detection equipment which detects the passing speed of said mobile station, and said propagation-loss measuring device and said passing speed detection equipment. When said passing speed is quick, the hysteresis margin for opting for initiation of connection with a base station and discharge is set up greatly. When said passing speed is slow, the software hand off base station selection equipment which sets up said hysteresis margin small is provided. This software hand off base station selection equipment Each relative propagation loss to said two or more base stations is grasped on the basis of the propagation loss of the base station which serves as the minimum propagation loss among the propagation loss to said two or more base stations. Ask for the fluctuation velocity of said relative propagation loss, and it judges whether said each base station and said mobile station connect. When said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds as a result of said judgment ] is less than the threshold function given as a function of said passing speed Sign division multiplex cellular mobile radio communication system characterized by starting connection with the base station in connectionless [ corresponding ].
[Claim 25] Said threshold function is sign division multiplex cellular mobile radio communication system according to claim 24 characterized by setting up so that it may give with the function which makes said passing speed an argument and may become such a big value that said passing speed is quick.
[Claim 26] Said software hand off base station selection equipment is sign division multiplex cellular mobile radio communication system according to claim 24 or 25 characterized by holding a connectionless condition with the base station in connectionless [ corresponding ] when said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds as a result of said judgment ] exceeds said threshold function.
[Claim 27] Said software hand off base station selection equipment is sign division multiplex cellular mobile radio communication system according to claim 24 or 25 characterized by to cancel connection with the base station under corresponding connection if said relative propagation loss to the base station under connection which connects and corresponds as a result of said judgment exceeds the level which added the hysteresis margin to said threshold function given as a function of said fluctuation velocity.
[Claim 28] Said software hand off base station selection equipment is sign division multiplex cellular mobile radio communication system according to claim 24 or 25 characterized by to hold a connection condition with the base station under corresponding connection when said relative

propagation loss to the base station under connection which connects and corresponds as a result of said judgment does not exceed the level which added the hysteresis margin to said threshold function given as a function of said fluctuation velocity.
[Claim 29] Mobile station equipment characterized by to have provided the software hand off base station selection equipment which sets up greatly the hysteresis margin for opting for initiation of connection with a base station, and discharge, and sets up said hysteresis margin small when fluctuation of said propagation loss is slow, and to be constituted when connecting with the propagation-loss measuring device which measures the propagation loss from a mobile station to each base station, and said propagation-loss measuring device and changing said propagation loss level at a high speed.
[Claim 30] It connects with the propagation-loss measuring device which measures the propagation loss from a mobile station to each base station, and said propagation-loss measuring device. When changing said propagation loss level at a high speed, the hysteresis margin for opting for initiation of connection with a base station and discharge is set up greatly. When fluctuation of said propagation loss is slow, the software hand off base station selection equipment which sets up said hysteresis margin small is provided. This software hand off base station selection equipment Each relative propagation loss to said two or more base stations is grasped on the basis of the propagation loss of the base station which serves as the minimum propagation loss among the propagation loss to said two or more base stations. Ask for the fluctuation velocity of said relative propagation loss, and it judges whether said each base station and said mobile station connect. Mobile station equipment characterized by starting connection with the base station in connectionless [ corresponding ] when said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds as a result of said judgment ] is less than the threshold function given as a function of said fluctuation velocity.
[Claim 31] Said threshold function is mobile station equipment according to claim 30 characterized by setting up so that it may give with the function which makes an argument fluctuation velocity of said relative propagation loss and may become such a big value that said fluctuation velocity is quick.
[Claim 32] Said software hand off base station selection equipment is mobile station equipment according to claim 30 or 31 characterized by holding a connectionless condition with the base station in connectionless [ corresponding ] when said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds as a result of said judgment ] exceeds said threshold function.
[Claim 33] Said software hand off base station selection equipment is mobile station equipment according to claim 30 or 31 characterized by canceling connection with the base station under corresponding connection if said relative propagation loss to the base station under connection which connects and corresponds as a result of said judgment exceeds the level which added the hysteresis margin to said threshold function given as a function of said fluctuation velocity.
[Claim 34] Said software hand off base station selection equipment is mobile station equipment according to claim 30 or 31 characterized by to hold a connection condition with the base station under corresponding connection when said relative propagation loss to the base station under connection which connects and corresponds as a result of said judgment does not exceed the level which added the hysteresis margin to said threshold function given as a function of said fluctuation velocity.
[Claim 35] The propagation-loss measuring device which measures the propagation loss from a mobile station to each base station, and the passing speed detection equipment which detects the

passing speed of said mobile station, It connects with said propagation-loss measuring device and said passing speed detection equipment. When said passing speed is quick, Mobile station equipment characterized by having provided the software hand off base station selection equipment which sets up greatly the hysteresis margin for opting for initiation of connection with a base station, and discharge, and sets up said hysteresis margin small when said passing speed is slow, and being constituted.

[Claim 36] The propagation-loss measuring device which measures the propagation loss from a mobile station to each base station, and the passing speed detection equipment which detects the passing speed of said mobile station, It connects with said propagation-loss measuring device and said passing speed detection equipment. When said passing speed is quick, The hysteresis margin for opting for initiation of connection with a base station and discharge is set up greatly. When said passing speed is slow, the software hand off base station selection equipment which sets up said hysteresis margin small is provided. This software hand off base station selection equipment Each relative propagation loss to said two or more base stations is grasped on the basis of the propagation loss of the base station which serves as the minimum propagation loss among the propagation loss to said two or more base stations. Ask for the fluctuation velocity of said relative propagation loss, and it judges whether said each base station and said mobile station connect. Mobile station equipment characterized by starting connection with the base station in connectionless [ corresponding ] when said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds as a result of said judgment ] is less than the threshold function given as a function of said passing speed.

[Claim 37] Said threshold function is mobile station equipment according to claim 36 characterized by setting up so that it may give with the function which makes said passing speed an argument and may become such a big value that said passing speed is quick.

[Claim 38] Said software hand off base station selection equipment is mobile station equipment according to claim 36 or 37 characterized by holding a connectionless condition with the base station in connectionless [ corresponding ] when said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds as a result of said judgment ] exceeds said threshold function.

[Claim 39] Said software hand off base station selection equipment is mobile station equipment according to claim 36 or 37 characterized by canceling connection with the base station under corresponding connection if said relative propagation loss to the base station under connection which connects and corresponds as a result of said judgment exceeds the level which added the hysteresis margin to said threshold function given as a function of said fluctuation velocity.

[Claim 40] Said software hand off base station selection equipment is mobile station equipment according to claim 36 or 37 characterized by to hold a connection condition with the base station under corresponding connection when said relative propagation loss to the base station under connection which connects and corresponds as a result of said judgment does not exceed the level which added the hysteresis margin to said threshold function given as a function of said fluctuation velocity.

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the base station selection approach and mobile station equipment for realizing efficient base station selection in the mobile station of the sign division multiplex cellular mobile radio communication system which carries out concurrent connection with two or more base stations, and this system.

[0002]
[Description of the Prior Art] Hereafter, the base station selection approach in the mobile station of the conventional sign division multiplex cellular mobile radio communication system is explained with reference to a drawing. Interference given to other wireless circuits must be suppressed to min by the base transceiver station of method plurality being unevenly distributed, and always connecting with the base station used as the minimum propagation loss the mobile station of the sign division multiplex cellular mobile radio communication system with which these base stations use the same frequency for coincidence, and carrying out transmitted power control. Since connection processing with a new base station takes a certain amount of time amount, the base station which serves as the minimum propagation loss depending on fluctuation of the propagation loss of the period may take the place, and interference may be given to the base station of a change place.
[0003] The interference to the base station of a change place produced in the case of connection processing with the above-mentioned new base station is explained to a detail with reference to drawing 9 and drawing 1010 . Here, it is Tc. It is connection threshold level and is Pp. It is the time amount which base station change processing takes, and is Cr. It is the time amount showing the period which does interference, and is T0. It is the base station connection threshold level in the conventional approach in the case of software hand off operation, and is T1. It is the base station connection release threshold level in the conventional approach in the case of software hand off operation.
[0004] The mobile station under connection with base station BS#A considers the case where it shifts to the zone of base station BS#B. When the difference of the propagation loss of base station BS#A and base station BS#B becomes smaller than the threshold level T, base station change processing is started, and change processing is Termination c. It is Pp about the time amount taken to carry out. It carries out. Pp A mobile station performs transmitted power control to base station BS#A between time amount.
[0005] As shown in drawing 9 , it is the connection processing time Pp. If the propagation loss of base station BS#B becomes smaller than that of base station BS#A in between, as for the mobile station which is performing transmitted power control to base station BS#A, interference will be given to base station BS#B with propagation loss smaller than base station BS#A. Namely, Cr shown in drawing 9 R> 9 Interference attains to base station BS#B between time amount.
[0006] The technique of a publication is known by proceeding Inn IEEE BIKYURA technology conference, 57 to 62 term, and the U.S. (Proceeding in IEEE Vehicular Technology Conference, pp.57-62, May, 1991) in May, 1991 as the technique of conquering the interference problem resulting from this connection processing. The technique with which connects concurrently with two or more base station candidates who include the base station which serves as the minimum propagation loss by the technique of a publication in the above-mentioned reference called a software hand off, and fluctuation of propagation loss is equipped is used. The situation was shown in drawing 10 .
[0007] The mobile station under connection with base station BS#A considers the case where it shifts to the zone of base station BS#B, like drawing 9 . The difference of the propagation loss of base station BS#A and BS#B is the threshold level T0. Connection with base station BS#B is started holding connection with base station BS#A, when it becomes small. Connection processing time Pp If it passes and connection processing with base station BS#B is completed, connection with both base stations will be started. The interference to base station BS#B from which the period of concurrent connection became a problem by drawing 9 since transmitted

power control to other lowest base stations of propagation loss was always carried out does not pose a problem. Then, the difference of the propagation loss of base station BS#A and BS#B is the threshold level T1. When it exceeds, connection with base station BS#A is canceled. Thus, by performing two or more base stations and concurrent connection in which propagation disadvantage level is tight, the shift of the minimum propagation loss base station can be coped with, and interference can be suppressed.

[0008] Threshold level T0 at the time of starting connection with a new base station Threshold level T1 at the time of canceling connection The latter is set up greatly. T0 called a hysteresis margin T1 When the difference of the propagation loss between base stations changes violently near threshold level, the difference is established in order to prevent that a base station connection release change occurs frequently. Threshold level T0 at the time of starting connection with a base station And threshold level T1 at the time of canceling connection The more it enlarges, the more the number of the base stations connected concurrently increases.

[0009]

[Problem(s) to be Solved by the Invention] However, the rate and magnitude of fluctuation of propagation loss from a mobile station to each base station change with the propagation environments of the passing speed of a mobile station, or the circumference. For example, in the city section in which a building etc. crowds, since there are many bodies which cover a radio-wave-propagation path, also in having progressed a slight distance, propagation loss changes a lot. That is, in the city section, fluctuation of propagation loss is quick and, moreover, large. On the other hand, since there are few bodies which cover a propagation path, fluctuation of propagation loss is slow and its magnitude is also small in the suburbs.

[0010] The propagation loss threshold level in the above-mentioned conventional base station sorting by selection is not based on a propagation environment, but is always made into fixed level. However, fluctuation of propagation loss, such as a city, needs to set up more greatly the propagation loss threshold level for connection release in a quick area, and needs to prepare for sudden fluctuation of propagation loss. Otherwise, connection with the base station used as the minimum propagation loss will be overdue, and interference will be given to this base station. It is possible to, set up propagation loss threshold level small on the other hand that what is necessary is just to connect with a small number of base station in the slow suburbs of propagation loss fluctuation. That is, on the pilot threshold level of immobilization, the excess and deficiency of a cocurrent connection base station arise, and employment of an efficient system cannot be realized.

[0011] Moreover, since frequent occurrence of a connection release change does not take place when fluctuation of propagation loss is slow, a hysteresis margin may be set up small. If a big hysteresis margin is set up superfluously rather, connection with a useless base station will be maintained and efficient employment of a system will be barred.

[0012] The purpose of this invention is losing the excess and deficiency of the cocurrent connection base station at the time of carrying out a software hand off, and realizing employment of an efficient system.

[0013]

[Means for Solving the Problem] Base station sorting by selection of this invention is characterized by changing base station selection threshold level and a hysteresis margin with the fluctuation velocity of propagation loss.

[0014] When changing a propagation member at a high speed, base station selection threshold level is enlarged, concurrent connection with many base stations is performed, and reliable base

station selection is realized. in addition -- and a hysteresis margin is set up greatly and frequent occurrence of a base station connection release change is prevented. On the other hand, when fluctuation of propagation loss is slow, base station selection threshold level is made small, concurrent connection with a small number of base station is performed, and increase in efficiency is attained. A hysteresis margin is small set as coincidence and connection with a useless base station is canceled a little early.

[0015] According to this invention, the base station which said mobile station connects by comparing the size of the propagation loss level from the mobile station in which connection with two or more base stations is possible to said base station group is chosen. In the base station selection approach of sign division multiplex cellular migration communication system of changing the base station which the communication link with two or more base stations is possible for said mobile station to coincidence, and is connected with migration of said mobile station The step which grasps each relative propagation loss to said two or more base stations on the basis of the propagation loss of the base station which serves as the minimum propagation loss among the propagation loss to said two or more base stations, The step which asks for the fluctuation velocity of said relative propagation loss, and the step which judges whether each base station and said mobile station connect, When said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds as a result of said judgment ] is less than the threshold function given as a function of said fluctuation velocity The base station selection approach in the sign division multiplex cellular mobile radio communication system characterized by having the step which starts connection with the base station in connectionless [ corresponding ] is acquired.

[0016] Furthermore, when said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds as a result of said judgment ] exceeds said threshold function according to this invention, the base station selection approach in the sign division multiplex cellular mobile radio communication system characterized by having a step holding a connectionless condition with the base station in connectionless [ corresponding ] is acquired.

[0017] Furthermore, if said relative propagation loss to the base station under connection which according to this invention connects and corresponds as a result of said judgment exceeds the level which added the hysteresis margin to said threshold function given as a function of said fluctuation velocity, the base station selection approach in the sign division multiplex cellular mobile radio communication system characterized by to cancel connection with the base station under corresponding connection will be acquired.

[0018] Furthermore, when said relative propagation loss to the base station under connection which connects and corresponds as a result of said judgment does not exceed the level which added a hysteresis margin to said threshold function given as a function of said fluctuation velocity according to this invention, the base station selection approach in the sign division multiplex cellular mobile radio communication system characterized by to have a step holding a connection condition with the base station under corresponding connection is acquired.

[0019] Furthermore, according to this invention, said threshold function is given with the function which makes an argument fluctuation velocity of said relative propagation loss, and the base station selection approach in the sign division multiplex cellular mobile radio communication system characterized by setting up so that it may become such a big value that said fluctuation velocity is quick is acquired.

[0020] Furthermore, according to this invention, said hysteresis margin is given with the function which makes an argument fluctuation velocity of said relative propagation loss, and the base station selection approach in the sign division multiplex cellular mobile radio communication system characterized by setting up so that it may become such a big value that said fluctuation velocity is quick is acquired.
[0021] Moreover, according to this invention, the base station which said mobile station connects by comparing the size of the propagation loss level from the mobile station in which connection with two or more base stations is possible to said base station group is chosen. In the base station selection approach of sign division multiplex cellular migration communication system of changing the base station which the communication link with two or more base stations is possible for said mobile station to coincidence, and is connected with migration of said mobile station The step which grasps each relative propagation loss to said two or more base stations on the basis of the propagation loss of the base station which serves as the minimum propagation loss among the propagation loss to said two or more base stations, The step which asks for the fluctuation velocity of said relative propagation loss, and the step which judges whether each base station and said mobile station connect, When said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds as a result of said judgment ] is less than the threshold function given as a function of the passing speed of said mobile station The base station selection approach in the sign division multiplex cellular mobile radio communication system characterized by having the step which starts connection with the base station in connectionless [ corresponding ] is acquired.
[0022] Furthermore, when said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds as a result of said judgment ] exceeds said threshold function according to this invention, the base station selection approach in the sign division multiplex cellular mobile radio communication system characterized by having a step holding a connectionless condition with the base station in connectionless [ corresponding ] is acquired.
[0023] Furthermore, if said relative propagation loss to the base station under connection which according to this invention connects and corresponds as a result of said judgment exceeds the level which added the hysteresis margin to said threshold function given as a function of said fluctuation velocity, the base station selection approach in the sign division multiplex cellular mobile radio communication system characterized by to cancel connection with the base station under corresponding connection will be acquired.
[0024] Furthermore, when said relative propagation loss to the base station under connection which connects and corresponds as a result of said judgment does not exceed the level which added a hysteresis margin to said threshold function given as a function of said fluctuation velocity according to this invention, the base station selection approach in the sign division multiplex cellular mobile radio communication system characterized by to have a step holding a connection condition with the base station under corresponding connection is acquired.
[0025] Furthermore, according to this invention, said threshold function is given with the function which makes passing speed of said mobile station an argument, and the base station selection approach in the sign division multiplex cellular mobile radio communication system characterized by setting up so that it may become such a big value that said passing speed is quick is acquired.
[0026] Furthermore, according to this invention, said hysteresis margin is given with the function which makes passing speed of said mobile station an argument, and the base station selection

approach in the sign division multiplex cellular mobile radio communication system characterized by setting up so that it may become such a big value that said passing speed is quick is acquired.

[0027] Moreover, the propagation-loss measuring device which measures the propagation loss from said mobile station to said each base station including two or more base stations and at least one mobile station according to this invention, When connecting with said propagation-loss measuring device and changing said propagation loss level at a high speed, The hysteresis margin for opting for initiation of connection with a base station and discharge is set up greatly. When fluctuation of said propagation loss is slow, the software hand off base station selection equipment which sets up said hysteresis margin small is provided. This software hand off base station selection equipment Each relative propagation loss to said two or more base stations is grasped on the basis of the propagation loss of the base station which serves as the minimum propagation loss among the propagation loss to said two or more base stations. Ask for the fluctuation velocity of said relative propagation loss, and it judges whether said each base station and said mobile station connect. When said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds as a result of said judgment ] is less than the threshold function given as a function of said fluctuation velocity The sign division multiplex cellular mobile radio communication system characterized by starting connection with the base station in connectionless [ corresponding ] is obtained.

[0028] Furthermore, according to this invention, said threshold function is given with the function which makes an argument fluctuation velocity of said relative propagation loss, and the sign division multiplex cellular mobile radio communication system characterized by setting up so that it may become such a big value that said fluctuation velocity is quick is obtained.

[0029] Furthermore, according to this invention, the sign division multiplex cellular mobile radio communication system characterized by said software hand off base station selection equipment holding a connectionless condition with the base station in connectionless [ corresponding ] when said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds ] exceeds said threshold function as a result of said judgment is obtained.

[0030] Furthermore, if it exceeds the level on which said relative propagation loss to the base station under connection which connects said software hand off base station selection equipment as a result of said judgment according to this invention, and corresponds added the hysteresis margin to said threshold function given as a function of said fluctuation velocity, the sign division multiplex cellular mobile radio communication system characterized by to cancel connection with the base station under corresponding connection will be obtained.

[0031] Furthermore, when said relative propagation loss to the base station under connection which connects said software hand off base station selection equipment as a result of said judgment according to this invention, and corresponds does not exceed the level which added the hysteresis margin to said threshold function given as a function of said fluctuation velocity, the sign division multiplex cellular mobile radio communication system characterized by to hold a connection condition with the base station under corresponding connection is obtained.

[0032] Moreover, the propagation-loss measuring device which measures the propagation loss from said mobile station to said each base station including two or more base stations and at least one mobile station according to this invention, It connects with the passing speed detection equipment which detects the passing speed of said mobile station, and said propagation-loss measuring device and said passing speed detection equipment. When said passing speed is quick,

the hysteresis margin for opting for initiation of connection with a base station and discharge is set up greatly. When said passing speed is slow, the software hand off base station selection equipment which sets up said hysteresis margin small is provided. This software hand off base station selection equipment Each relative propagation loss to said two or more base stations is grasped on the basis of the propagation loss of the base station which serves as the minimum propagation loss among the propagation loss to said two or more base stations. Ask for the fluctuation velocity of said relative propagation loss, and it judges whether said each base station and said mobile station connect. When said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds as a result of said judgment ] is less than the threshold function given as a function of said passing speed The sign division multiplex cellular mobile radio communication system characterized by starting connection with the base station in connectionless [ corresponding ] is obtained.

[0033] Furthermore, according to this invention, said threshold function is given with the function which makes said passing speed an argument, and the sign division multiplex cellular mobile radio communication system characterized by setting up so that it may become such a big value that said passing speed is quick is obtained.

[0034] Furthermore, according to this invention, the sign division multiplex cellular mobile radio communication system characterized by said software hand off base station selection equipment holding a connectionless condition with the base station in connectionless [ corresponding ] when said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds ] exceeds said threshold function as a result of said judgment is obtained.

[0035] Furthermore, if it exceeds the level on which said relative propagation loss to the base station under connection which connects said software hand off base station selection equipment as a result of said judgment according to this invention, and corresponds added the hysteresis margin to said threshold function given as a function of said fluctuation velocity, the sign division multiplex cellular mobile radio communication system characterized by to cancel connection with the base station under corresponding connection will be obtained.

[0036] Furthermore, when said relative propagation loss to the base station under connection which connects said software hand off base station selection equipment as a result of said judgment according to this invention, and corresponds does not exceed the level which added the hysteresis margin to said threshold function given as a function of said fluctuation velocity, the sign division multiplex cellular mobile radio communication system characterized by to hold a connection condition with the base station under corresponding connection is obtained.

[0037] Moreover, the propagation-loss measuring device which measures the propagation loss from a mobile station to each base station according to this invention, When connecting with said propagation-loss measuring device and changing said propagation loss level at a high speed, The hysteresis margin for opting for initiation of connection with a base station and discharge is set up greatly. When fluctuation of said propagation loss is slow, the software hand off base station selection equipment which sets up said hysteresis margin small is provided. This software hand off base station selection equipment Each relative propagation loss to said two or more base stations is grasped on the basis of the propagation loss of the base station which serves as the minimum propagation loss among the propagation loss to said two or more base stations. Ask for the fluctuation velocity of said relative propagation loss, and it judges whether said each base station and said mobile station connect. When said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds as a result of said judgment ] is

less than the threshold function given as a function of said fluctuation velocity, the mobile station equipment characterized by starting connection with the base station in connectionless [ corresponding ] is obtained.

[0038] Furthermore, according to this invention, said threshold function is given with the function which makes an argument fluctuation velocity of said relative propagation loss, and the mobile station equipment characterized by setting up so that it may become such a big value that said fluctuation velocity is quick is obtained.

[0039] Furthermore, according to this invention, the mobile station equipment characterized by said software hand off base station selection equipment holding a connectionless condition with the base station in connectionless [ corresponding ] when said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds ] exceeds said threshold function as a result of said judgment is obtained.

[0040] Furthermore, if it exceeds the level on which said relative propagation loss to the base station under connection which connects said software hand off base station selection equipment as a result of said judgment according to this invention, and corresponds added the hysteresis margin to said threshold function given as a function of said fluctuation velocity, the mobile station equipment characterized by to cancel connection with the base station under corresponding connection will be obtained.

[0041] Furthermore, when said relative propagation loss to the base station under connection which connects said software hand off base station selection equipment as a result of said judgment according to this invention, and corresponds does not exceed the level which added the hysteresis margin to said threshold function given as a function of said fluctuation velocity, the mobile station equipment characterized by to hold a connection condition with the base station under corresponding connection is obtained.

[0042] Moreover, the propagation-loss measuring device which measures the propagation loss from a mobile station to each base station according to this invention, It connects with the passing speed detection equipment which detects the passing speed of said mobile station, and said propagation-loss measuring device and said passing speed detection equipment. When said passing speed is quick, the hysteresis margin for opting for initiation of connection with a base station and discharge is set up greatly. When said passing speed is slow, the software hand off base station selection equipment which sets up said hysteresis margin small is provided. This software hand off base station selection equipment Each relative propagation loss to said two or more base stations is grasped on the basis of the propagation loss of the base station which serves as the minimum propagation loss among the propagation loss to said two or more base stations. Ask for the fluctuation velocity of said relative propagation loss, and it judges whether said each base station and said mobile station connect. When said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds as a result of said judgment ] is less than the threshold function given as a function of said passing speed, the mobile station equipment characterized by starting connection with the base station in connectionless [ corresponding ] is obtained.

[0043] Furthermore, according to this invention, said threshold function is given with the function which makes said passing speed an argument, and the mobile station equipment characterized by setting up so that it may become such a big value that said passing speed is quick is obtained.

[0044] Furthermore, according to this invention, the mobile station equipment characterized by said software hand off base station selection equipment holding a connectionless condition with

the base station in connectionless [ corresponding ] when said relative propagation loss to the base station in connectionless [ which is among connectionless and corresponds ] exceeds said threshold function as a result of said judgment is obtained.
[0045] Furthermore, if it exceeds the level on which said relative propagation loss to the base station under connection which connects said software hand off base station selection equipment as a result of said judgment according to this invention, and corresponds added the hysteresis margin to said threshold function given as a function of said fluctuation velocity, the mobile station equipment characterized by to cancel connection with the base station under corresponding connection will be obtained.
[0046] Furthermore, when said relative propagation loss to the base station under connection which connects said software hand off base station selection equipment as a result of said judgment according to this invention, and corresponds does not exceed the level which added the hysteresis margin to said threshold function given as a function of said fluctuation velocity, the mobile station equipment characterized by to hold a connection condition with the base station under corresponding connection is obtained.
[0047]
[Embodiment of the Invention] Hereafter, the gestalt of 1 operation of this invention is explained to a detail with reference to a drawing. Drawing 1 is drawing showing the connection condition in the software hand off of sign division multiplex cellular mobile radio communication system. drawing 2 and drawing 3 show the mobile station equipment and the base station equipment which is alike and constitutes a base station 12-1 and 12-2 which constitutes the mobile station 13 in the gestalt of operation of this invention, respectively.
[0048] First, actuation of the mobile station equipment shown in drawing 2 is explained. After it is received in the transmission-and-reception shared device 21 and the sending signal emitted from the base station passes through the RF section 22, it is inputted into passing speed detection equipment 23 and the propagation loss measuring device 24. two or more base stations which the passing speed Vms of a mobile station own [ this ] is outputted, and are located in the neighborhood of this mobile station in the propagation-loss measuring device 24 on the other hand with passing speed detection equipment 23 -- respectively -- ** -- a propagation loss Li -- (t [dB]) estimates. Here, t expresses measurement time of day for the base station index with which i is given for the integer of0-N again. In addition, it is estimated with said transmitting output of the receiving reinforcement of the pilot signal with which for example, each base station emits two or more propagation losses to a base station, and a pilot signal. Passing speed Vms and a propagation loss Li (t) are inputted into software hand off base station selection equipment BSS, and determine the base station which cancels the base station or connection which newly serves as a software hand off object. The decision result of a base station of which the new base station for a software hand off or connection is canceled is given as connection release variables BSinfo and i. BSinfo and i= 1 mean a connection request with the corresponding base station i, BSinfo and i=-1 mean connection release with the corresponding base station i, and it means further that BSinfo and i= 0 hold the present connection condition. The connection release variables BSinfo and i determined by software hand off base station selection equipment BSS are inputted into control signal generation equipment 31, and generate a control signal to that effect to the base station group of which connection or discharge is required. The output and transmit information 26 of control signal generation equipment 31 are combined in a coupler 25, and various additional information is inserted in the overhead insertion section 30. After the output signal of

the overhead insertion section 30 passes a diffuser 29, a modulator 28, and an amplifying device 27, it is emitted towards a base station by the transmission-and-reception shared device 21.
[0049] Next, actuation of the base station equipment shown in drawing 3 is explained. After the sending signal emitted from the mobile station 13 passes the transmission-and-reception shared device 41, it restores to it through the RF section 42 and a demodulator 43. The control signal included in the output of a demodulator 43 is detected in control signal detection equipment 44. The detected control signal is transmitted to the exchange 11, and connection of the base station which corresponds based on the base station connection command or base station connection release command included in a control signal at the exchange 11, and discharge processing are carried out.
[0050] Next, the gestalt of 1 implementation of actuation of the software hand off base station selection equipment BSS shown in drawing 2 is shown in drawing 4 . With the gestalt of operation of drawing 4 , from propagation-loss Li(t) [dB] of a mobile station and a base station i, it asked for propagation loss fluctuation velocity, and this has determined connection release threshold level.
[0051] first, the step 100 -- setting -- the propagation loss Li with a base station i -- the inside of (t [dB]) -- the minimum value -- Lmin -- it is defined as (t [dB]). Next, in step 101, 0 is set as loop variable k showing a base station number. step 102 -- setting -- the propagation loss Lk with a base station k -- Lmin from (t [dB]) -- (t [dB]) -- deducting -- relative propagation loss level Ln and k [dB] is obtained. In step 103, the absolute value [Ln, k (t)] of the differential value of Ln and k (t) is calculated. In step 104, if it judges whether a base station k and a mobile station are talking over the telephone or there is nothing, it is under message about it and it is not [ be / it ] under message to step 105, it will progress to step 106.
[0052] In step 104, the value of the discharge threshold level Tr defined as a function of a rate is calculated, and if Tr (|Ln and k (t) |) is smaller than Ln and k (t), and that is not right, it will progress to step 107 to step 108. Connection threshold level Ta defined as a function of a rate in step 106 on the other hand A value is calculated, if Ta (|Ln and k (t) |) is larger than Ln and k (t), it will progress to step 109, otherwise, it progresses to step 108. In step 107, the connection release variable BSinfo meaning connection release with a base station k and k=-1 are set up, and the connection release variable BSinfo which means connection with a base station k in step 109, and k= 1 are set up. In step 108, the connection release variable BSinfo and k= 0 are set up so that a connection condition with a base station k may be held. After steps 107-109, it progresses to step 110 and it is judged whether loop variable k is over the number N of base stations. If it is k<N, after adding 1 to k in step 111, it will return to step 102. With [ k ] N [ more than ], the connection release variables BSinfo and i are outputted towards the control signal generation equipment 31 shown in drawing 2 .
[0053] In addition, with the gestalt of this operation, the passing speed Vms of a mobile station own [ this ] detected with passing speed detection equipment 23 is not used, but carries out termination in step 102.
[0054] Drawing 5 is the connection threshold level function Ta. And discharge threshold level function Tr An example is shown. Ta and Tr **** -- | showing the magnitude of the fluctuation velocity of Ln and I (t) -- Ln and i (t) It sets up so that it may become so large that | becomes large. moreover, discharge threshold level Tr Ta it becomes high by the hysteresis margin -- as -- setting up -- and a hysteresis margin -- | -- Ln and i It is made so large that (t) | is large. The connection processing and discharge processing of a base station i by the flow chart shown in drawing 4 can be explained as follows using drawing 5 .

[0055] When a base station i does not connect, a point (|Ln, i (t) |, Ln, i (t)) is sketched on drawing 5 , and this point is the connection threshold level Ta. When located in the lower part, this base station is chosen as a connection base station. On the other hand, when a base station i already connects, a point (|Ln, i (t) |, Ln, i (t)) is sketched on drawing 2 , and when this point is located above the discharge threshold level Tr, connection with this base station is canceled. When other, the present connection condition is maintained.
[0056] Next, Ta shown in drawing 5 and Tr An example from the base station selection at the time of applying to discharge is described. To drawing 6 , it is |Ln and i about Ln, i (t), and an axis of abscissa in an axis of ordinate. (t) The curve showed the locus of the point (|Ln, i (t) | pair Ln, i(t)) sketched on the graph made into |. A point (|Ln, |Ln of i(t), i (t) |) changes in the direction of the arrow head shown in drawing 6 in connection with the passage of time.
[0057] A point (|Ln, i (t) |, Ln, i (t)) is at the time a Ta, i.e., base station selection threshold level. When less, connection processing with a base station i is started. pass connection processing -- a time -- b -- a base station i -- connection is started. (Then, Time c Tr, i.e., discharge threshold level, When it exceeds, connection with a base station i is canceled immediately.) After all, the period from a point in time b to a point in time c and the communication link with a base station i are performed.
[0058] The gestalt of other operations of this invention is explained with reference to a drawing below.
[0059] Drawing 8 shows the gestalt of other operations of the software hand off base station selection equipment BSS shown in drawing 2 . From the fact proportional to the passing speed of a terminal, the fluctuation velocity of propagation loss has determined connection release threshold level with the gestalt of operation of drawing 8 with the own passing speed Vms of a mobile station detected with passing speed detection equipment 23.
[0060] first, the step 200 -- setting -- the propagation loss Li of a base station i and this mobile station -- the minimum value of (the t [dB]) -- Lmin -- it is defined as (t [dB]). Next, in step 201, 0 is set as loop variable k showing a base station number. step 202 -- setting -- the propagation loss Lk with a base station k -- Lmin from (t [dB]) -- (t [dB]) -- deducting -- relative propagation loss level Ln and k [dB] is obtained. In step 203, if it judges whether a base station k and a mobile station are talking over the telephone or there is nothing, it is under message about it and it is not [ be / it ] under message to step 204, it will progress to step 205.
[0061] Discharge threshold level Tr which the passing speed Vms of a mobile station own [ this ] detected with passing speed detection equipment 23 is inputted into step 204, and is defined as a function of a rate A value is calculated, and if Tr (Vms) is smaller than Ln and k (t), and that is not right, it will progress to step 206 to step 207. Connection threshold level Ta defined as a function of a rate in step 205 on the other hand A value is calculated, if Ta (Vms) is larger than Ln and k (t), it will progress to step 208, otherwise, it progresses to step 207. In step 206, the connection release variable BSinfo meaning connection release with a base station k and k=-1 are set up, and the connection release variable BSinfo which means connection with a base station k in step 208, and k= 1 are set up. In step 207, the connection release variable BSinfo and k= 0 are set up so that a connection condition with a base station k may be held. After steps 206-208, it progresses to step 209 and it is judged whether loop variable k is over the number N of base stations. If it is k<N, after adding 1 to k in step 210, it will return to step 202. If k> is more than =N, the connection release variables BSinfo and i will be outputted towards the control signal refiner 31 shown in drawing 2 .

[0062] The fluctuation velocity of propagation loss is proportional to the passing speed of a terminal. The operation gestalt shown in drawing 8 is the technique of presuming the fluctuation velocity of propagation loss indirectly from the passing speed of a terminal. In the gestalt of operation shown in drawing 4 , the fluctuation velocity of propagation loss was directly detected by differentiating the presumed result of propagation loss. When an error component is contained in the presumed result of propagation loss in the case of drawing 4 R> 4, a propagation loss presumption error spreads to fluctuation velocity estimate, and there is a problem which an error produces also in fluctuation velocity estimate. On the other hand, according to the gestalt of operation shown in drawing 8 , since a propagation loss presumption error and a propagation loss fluctuation velocity error are divided, error propagation is avoidable.
[0063]
[Effect of the Invention] As explained above, according to this invention, by changing base station selection threshold level and a hysteresis margin with the fluctuation velocity of propagation loss, the communication link with a proper number according to the passing speed of a propagation environment or a mobile station of base stations is attained, and efficient and reliable base station selection can be realized.
[Brief Description of the Drawings]
[Drawing 1] It is drawing showing the connection condition in the software hand off of sign division multiplex cellular mobile radio communication system.
[Drawing 2] It is drawing showing the configuration of the mobile station equipment of this invention.
[Drawing 3] It is drawing showing the configuration of the base station equipment of this invention.
[Drawing 4] It is the flow chart having shown each step of the base station selection approach of this invention.
[Drawing 5] It is drawing showing an example of the threshold level for base station connection and discharge.
[Drawing 6] It is drawing showing an example from base station connection to discharge.
[Drawing 7] It is drawing showing the average cocurrent connection base station in near [ to the passing speed of a mobile station ] a cel boundary.
[Drawing 8] It is the flow chart having shown each step of other base station selection approaches of this invention.
[Drawing 9] It is drawing showing the base station change process over the propagation loss fluctuation when not carrying out a software hand off in the conventional technique.
[Drawing 10] It is drawing showing the base station change process in the case of carrying out a software hand off in the conventional technique which carries out propagation loss fluctuation.
[Description of Notations]
Lmin (t) The minimum propagation loss measurement level
Ln, i (t) Relative propagation loss measurement level which deducted the minimum propagation loss measurement level
Ta Connection threshold level function
Tr Discharge threshold level function
Base station connection processing initiation time
b Base station connection initiation time
c Base station connection release time
BS#A Connecting agency base station

BS#B Connection place base station
BSS Software hand off base station selection equipment
11 Exchange
12-1, 12-2 Base station
13 Mobile Station
16-1 Connection Field with Base Station 12-1
16-2 Connection Field with Base Station 12-2
21 Transmission-and-Reception Shared Device
22 The RF Section
23 Passing Speed Detection Equipment
24 Propagation-Loss Measuring Device
25 Coupler
26 Transmit Information
27 Amplifying Device
28 Modulator
29 Diffuser
30 Overhead Insertion Section
31 Control Signal Generation Equipment
41 Transmission-and-Reception Shared Device
42 The RF Section
43 Demodulator
44 Control Signal Detection Equipment

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(71)出願人　000004237
日本電気株式会社
東京都港区芝五丁目７番１号

(72)発明者　古川　浩
東京都港区芝五丁目７番１号　日本電気株式会社内

(74)代理人　弁理士　後藤　洋介　（外１名）

(54)【発明の名称】　符号分割多重セルラー移動無線通信システム、基地局選択方法、及び移動局装置

(57)【要約】

【課題】　符号分割多重セルラー移動無線通信システムにおいて、ソフトハンドオフを実施する際の同時接続基地局の過不足を無くし、効率的なシステムの運用を実現することである。

【解決手段】　パイロット信号の受信レベルより見積もられる伝搬損の変動速度によって基地局選択しきいレベルならびにスステリシスマージンを変化させることによって、伝搬環境や移動局の移動速度に応じた適正な数の基地局との通信を可能とする。

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【特許請求の範囲】

【請求項１】　複数の基地局との接続が可能な移動局から前記複数の基地局までの伝搬損レベルの大小を比較することによって前記移動局が接続する基地局を選択し、前記移動局は同時に複数の基地局との通信が可能であり、前記移動局の移動に伴って接続する基地局を変更する符号分割多重セルラー移動通信システムの基地局選択方法において、前記伝搬損レベルが高速に変動する場合、前記接続する基地局を多くなるように選択し、前記伝搬損の変動が緩慢な場合、前記接続する基地局が少なくなるように選択することを特徴とする符号分割多重セルラー移動無線通信システムにおける基地局選択方法。

【請求項２】　複数の基地局との接続が可能な移動局から前記複数の基地局までの伝搬損レベルの大小を比較することによって前記移動局が接続する基地局を選択し、前記移動局は同時に複数の基地局との通信が可能であり、前記移動局の移動に伴って接続する基地局を変更する符号分割多重セルラー移動通信システムの基地局選択方法において、前記伝搬損レベルが高速に変動する場合、基地局との接続の開始、解除を決めるためのヒステリシスマージンを大きく設定し、前記伝搬損の変動が緩慢な場合、前記ヒステリシスマージンを小さく設定することを特徴とする符号分割多重セルラー移動無線通信システムにおける基地局選択方法。

【請求項３】　複数の基地局との接続が可能な移動局から前記基地局群までの伝搬損レベルの大小を比較することによって前記移動局が接続する基地局を選択し、前記移動局は同時に複数の基地局との通信が可能であり、前記移動局の移動に伴って接続する基地局を変更する符号分割多重セルラー移動通信システムの基地局選択方法において、前記複数の基地局に対する伝搬損のうち最小伝搬損となる基地局の伝搬損を基準として前記複数の基地局に対するそれぞれの相対伝搬損を把握するステップと、前記相対伝搬損の変動速度を求めるステップと、各基地局と前記移動局が接続中であるか否かを判定するステップと、前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられるしきい関数を下回る場合には、該当する非接続中の基地局との接続を開始するステップを有することを特徴とする符号分割多重セルラー移動無線通信システムにおける基地局選択方法。

【請求項４】　前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が前記しきい関数を上回る場合には、該当する非接続中の基地局との非接続状態を保持するステップを有することを特徴とする請求項３記載の符号分割多重セルラー移動無線通信システムにおける基地局選択方法。

【請求項５】　前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回れば、該当する接続中の基地局との接続を解除することを特徴とする請求項３記載の符号分割多重セルラー移動無線通信システムにおける基地局選択方法。

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【請求項６】　前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回らない場合には、該当する接続中の基地局との接続状態を保持するステップを有することを特徴とする請求項３に記載の符号分割多重セルラー移動無線通信システムにおける基地局選択方法。

【請求項７】　前記しきい関数は、前記相対伝搬損の変動速度を引数とする関数で与え、前記変動速度が速いほど大きな値となるように設定することを特徴とする請求項３乃至６のいずれか一つに記載の符号分割多重セルラー移動無線通信システムにおける基地局選択方法。

【請求項８】　前記ヒステリシスマージンは、前記相対伝搬損の変動速度を引数とする関数で与え、前記変動速度が速いほど大きな値となるように設定することを特徴とする請求項３乃至６のいずれか一つに記載の符号分割多重セルラー移動無線通信システムにおける基地局選択方法。

【請求項９】　複数の基地局との接続が可能な移動局から前記複数の基地局までの伝搬損レベルの大小を比較することによって前記移動局が接続する基地局を選択し、前記移動局は同時に複数の基地局との通信が可能であり、前記移動局の移動に伴って接続する基地局を変更する符号分割多重セルラー移動通信システムの基地局選択方法において、前記移動局の移動速度が速い場合、前記接続する基地局を多くなるように選択し、前記移動局の移動速度が遅い場合、前記接続する基地局が少なくなるように選択することを特徴とする符号分割多重セルラー移動無線通信システムにおける基地局選択方法。

【請求項１０】　複数の基地局との接続が可能な移動局から前記複数の基地局までの伝搬損レベルの大小を比較することによって前記移動局が接続する基地局を選択し、前記移動局は同時に複数の基地局との通信が可能であり、前記移動局の移動に伴って接続する基地局を変更する符号分割多重セルラー移動通信システムの基地局選択方法において、前記移動局の移動速度が速い場合、前記基地局との接続の開始、解除を決めるためのヒステリシスマージンを大きく設定し、前記移動局の移動速度が遅い場合、前記ヒステリシスマージンを小さく設定することを特徴とする符号分割多重セルラー移動無線通信システムにおける基地局選択方法。

【請求項１１】　複数の基地局との接続が可能な移動局から前記基地局群までの伝搬損レベルの大小を比較することによって前記移動局が接続する基地局を選択し、前記移動局は同時に複数の基地局との通信が可能であり、

前記移動局の移動に伴って接続する基地局を変更する符号分割多重セルラー移動通信システムの基地局選択方法において、前記複数の基地局に対する伝搬損のうち最小伝搬損となる基地局の伝搬損を基準として前記複数の基地局に対するそれぞれの相対伝搬損を把握するステップと、前記相対伝搬損の変動速度を求めるステップと、各基地局と前記移動局が接続中であるか否かを判定するステップと、前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が、前記移動局の移動速度の関数として与えられるしきい関数を下回る場合には、該当する非接続中の基地局との接続を開始するステップを有することを特徴とする符号分割多重セルラー移動無線通信システムにおける基地局選択方法。

【請求項１２】　前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が前記しきい関数を上回る場合には、該当する非接続中の基地局との非接続状態を保持するステップを有することを特徴とする請求項１１記載の符号分割多重セルラー移動無線通信システムにおける基地局選択方法。

【請求項１３】　前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回れば、該当する接続中の基地局との接続を解除することを特徴とする請求項１１記載の符号分割多重セルラー移動無線通信システムにおける基地局選択方法。

【請求項１４】　前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回らない場合には、該当する接続中の基地局との接続状態を保持するステップを有することを特徴とする請求項１１記載の符号分割多重セルラー移動無線通信システムにおける基地局選択方法。

【請求項１５】　前記しきい関数は、前記移動局の移動速度を引数とする関数で与え、前記移動速度が速いほど大きな値となるように設定することを特徴とする請求項１１乃至１４のいずれか一つに記載の符号分割多重セルラー移動無線通信システムにおける基地局選択方法。

【請求項１６】　前記ヒステリシスマージンは、前記移動局の移動速度を引数とする関数で与え、前記移動速度が速いほど大きな値となるように設定することを特徴とする請求項１１乃至１４のいずれか一つに記載の符号分割多重セルラー移動無線通信システムにおける基地局選択方法。

【請求項１７】　複数の基地局と少なくとも一つの移動局を含み、前記移動局から前記各基地局への伝搬損失を測定する伝搬損失測定装置と、前記伝搬損失測定装置に接続され、前記伝搬損レベルが高速に変動する場合、基地局との接続の開始、解除を決めるためのヒステリシスマージンを大きく設定し、前記伝搬損の変動が緩慢な場合、前記ヒステリシスマージンを小さく設定するソフトハンドオフ基地局選定装置を具備して構成されたことを特徴とする符号分割多重セルラー移動無線通信システム。



【請求項１８】　複数の基地局と少なくとも一つの移動局を含み、前記移動局から前記各基地局への伝搬損失を測定する伝搬損失測定装置と、前記伝搬損失測定装置に接続され、前記伝搬損レベルが高速に変動する場合、基地局との接続の開始、解除を決めるためのヒステリシスマージンを大きく設定し、前記伝搬損の変動が緩慢な場合、前記ヒステリシスマージンを小さく設定するソフトハンドオフ基地局選定装置を具備し、該ソフトハンドオフ基地局選定装置は、前記複数の基地局に対する伝搬損のうち最小伝搬損となる基地局の伝搬損を基準として前記複数の基地局に対するそれぞれの相対伝搬損を把握し、前記相対伝搬損の変動速度を求め、前記各基地局と前記移動局が接続中であるか否かを判定し、前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられるしきい関数を下回る場合には、該当する非接続中の基地局との接続を開始することを特徴とする符号分割多重セルラー移動無線通信システム。

【請求項１９】　前記しきい関数は、前記相対伝搬損の変動速度を引数とする関数で与え、前記変動速度が速いほど大きな値となるように設定することを特徴とする請求項１８記載の符号分割多重セルラー移動無線通信システム。

【請求項２０】　前記ソフトハンドオフ基地局選定装置は、前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が前記しきい関数を上回る場合には、該当する非接続中の基地局との非接続状態を保持することを特徴とする請求項１８又は１９記載の符号分割多重セルラー移動無線通信システム。

【請求項２１】　前記ソフトハンドオフ基地局選定装置は、前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回れば、該当する接続中の基地局との接続を解除することを特徴とする請求項１８又は１９に記載の符号分割多重セルラー移動無線通信システム。

【請求項２２】　前記ソフトハンドオフ基地局選定装置は、前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回らない場合には、該当する接続中の基地局との接続状態を保持することを特徴とする請求項１８又は１９記載の符号分割多重セルラー移動無線通信システム。

【請求項２３】　複数の基地局と少なくとも一つの移動

局を含み、前記移動局から前記各基地局への伝搬損失を測定する伝搬損失測定装置と、前記移動局の移動速度を検出する移動速度検出装置と、前記伝搬損失測定装置及び前記移動速度検出装置に接続され、前記移動速度が速い場合、基地局との接続の開始、解除を決めるためのヒステリシスマージンを大きく設定し、前記移動速度が遅い場合、前記ヒステリシスマージンを小さく設定するソフトハンドオフ基地局選定装置を具備して構成されたことを特徴とする符号分割多重セルラー移動無線通信システム。

【請求項24】 複数の基地局と少なくとも一つの移動局を含み、前記移動局から前記各基地局への伝搬損失を測定する伝搬損失測定装置と、前記移動局の移動速度を検出する移動速度検出装置と、前記伝搬損失測定装置及び前記移動速度検出装置に接続され、前記移動速度が速い場合、基地局との接続の開始、解除を決めるためのヒステリシスマージンを大きく設定し、前記移動速度が遅い場合、前記ヒステリシスマージンを小さく設定するソフトハンドオフ基地局選定装置を具備し、該ソフトハンドオフ基地局選定装置は、前記複数の基地局に対する伝搬損のうち最小伝搬損となる基地局の伝搬損を基準として前記複数の基地局に対するそれぞれの相対伝搬損を把握し、前記相対伝搬損の変動速度を求め、前記各基地局と前記移動局が接続中であるか否かを判定し、前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が、前記移動速度の関数として与えられるしきい関数を下回る場合には、該当する非接続中の基地局との接続を開始することを特徴とする符号分割多重セルラー移動無線通信システム。

【請求項25】 前記しきい関数は、前記移動速度を引数とする関数で与え、前記移動速度が速いほど大きな値となるように設定することを特徴とする請求項24記載の符号分割多重セルラー移動無線通信システム。

【請求項26】 前記ソフトハンドオフ基地局選定装置は、前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が前記しきい関数を上回る場合には、該当する非接続中の基地局との非接続状態を保持することを特徴とする請求項24又は25記載の符号分割多重セルラー移動無線通信システム。

【請求項27】 前記ソフトハンドオフ基地局選定装置は、前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回れば、該当する接続中の基地局との接続を解除することを特徴とする請求項24又は25に記載の符号分割多重セルラー移動無線通信システム。

【請求項28】 前記ソフトハンドオフ基地局選定装置は、前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回らない場合には、該当する接続中の基地局との接続状態を保持することを特徴とする請求項24又は25記載の符号分割多重セルラー移動無線通信システム。

【請求項29】 移動局から各基地局への伝搬損失を測定する伝搬損失測定装置と、前記伝搬損失測定装置に接続され、前記伝搬損レベルが高速に変動する場合、基地局との接続の開始、解除を決めるためのヒステリシスマージンを大きく設定し、前記伝搬損の変動が緩慢な場合、前記ヒステリシスマージンを小さく設定するソフトハンドオフ基地局選定装置を具備して構成されたことを特徴とする移動局装置。

【請求項30】 移動局から各基地局への伝搬損失を測定する伝搬損失測定装置と、前記伝搬損失測定装置に接続され、前記伝搬損レベルが高速に変動する場合、基地局との接続の開始、解除を決めるためのヒステリシスマージンを大きく設定し、前記伝搬損の変動が緩慢な場合、前記ヒステリシスマージンを小さく設定するソフトハンドオフ基地局選定装置を具備し、該ソフトハンドオフ基地局選定装置は、前記複数の基地局に対する伝搬損のうち最小伝搬損となる基地局の伝搬損を基準として前記複数の基地局に対するそれぞれの相対伝搬損を把握し、前記相対伝搬損の変動速度を求め、前記各基地局と前記移動局が接続中であるか否かを判定し、前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられるしきい関数を下回る場合には、該当する非接続中の基地局との接続を開始することを特徴とする移動局装置。

【請求項31】 前記しきい関数は、前記相対伝搬損の変動速度を引数とする関数で与え、前記変動速度が速いほど大きな値となるように設定することを特徴とする請求項30記載の移動局装置。

【請求項32】 前記ソフトハンドオフ基地局選定装置は、前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が前記しきい関数を上回る場合には、該当する非接続中の基地局との非接続状態を保持することを特徴とする請求項30又は31記載の移動局装置。

【請求項33】 前記ソフトハンドオフ基地局選定装置は、前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回れば、該当する接続中の基地局との接続を解除することを特徴とする請求項30又は31に記載の移動局装置。

【請求項34】 前記ソフトハンドオフ基地局選定装置は、前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージン

を加えたレベルを上回らない場合には、該当する接続中の基地局との接続状態を保持することを特徴とする請求項30又は31記載の移動局装置。

【請求項35】 移動局から各基地局への伝搬損失を測定する伝搬損失測定装置と、前記移動局の移動速度を検出する移動速度検出装置と、前記伝搬損失測定装置及び前記移動速度検出装置に接続され、前記移動速度が速い場合、基地局との接続の開始、解除を決めるためのヒステリシスマージンを大きく設定し、前記移動速度が遅い場合、前記ヒステリシスマージンを小さく設定するソフトハンドオフ基地局選定装置を具備して構成されたことを特徴とする移動局装置。

【請求項36】 移動局から各基地局への伝搬損失を測定する伝搬損失測定装置と、前記移動局の移動速度を検出する移動速度検出装置と、前記伝搬損失測定装置及び前記移動速度検出装置に接続され、前記移動速度が速い場合、基地局との接続の開始、解除を決めるためのヒステリシスマージンを大きく設定し、前記移動速度が遅い場合、前記ヒステリシスマージンを小さく設定するソフトハンドオフ基地局選定装置を具備し、該ソフトハンドオフ基地局選定装置は、前記複数の基地局に対する伝搬損のうち最小伝搬損となる基地局の伝搬損を基準として前記複数の基地局に対するそれぞれの相対伝搬損を把握し、前記相対伝搬損の変動速度を求め、前記各基地局と前記移動局が接続中であるか否かを判定し、前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が、前記移動速度の関数として与えられるしきい関数を下回る場合には、該当する非接続中の基地局との接続を開始することを特徴とする移動局装置。

【請求項37】 前記しきい関数は、前記移動速度を引数とする関数で与え、前記移動速度が速いほど大きな値となるように設定することを特徴とする請求項36記載の移動局装置。

【請求項38】 前記ソフトハンドオフ基地局選定装置は、前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が前記しきい関数を上回る場合には、該当する非接続中の基地局との非接続状態を保持することを特徴とする請求項36又は37記載の移動局装置。

【請求項39】 前記ソフトハンドオフ基地局選定装置は、前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回れば、該当する接続中の基地局との接続を解除することを特徴とする請求項36又は37に記載の移動局装置。

【請求項40】 前記ソフトハンドオフ基地局選定装置は、前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回らない場合には、該当する接続中の基地局との接続状態を保持することを特徴とする請求項36又は37記載の移動局装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、複数の基地局との同時接続を実施する符号分割多重セルラー移動無線通信システム、該システムの移動局において、効率的な基地局選択を実現するための基地局選択方法、及び移動局装置に関するものである。

【0002】

【従来の技術】以下、従来の符号分割多重セルラー移動無線通信システムの移動局における基地局選択方法について図面を参照して説明する。方式複数の無線基地局が偏在し、これらの基地局が同一周波数を同時に使用する符号分割多重セルラー移動無線通信システムの移動局は、最小伝搬損失となる基地局と常に接続し、かつ送信電力制御を実施することによって他の無線回線へ与える干渉を最小に抑えなくてはならない。新しい基地局との接続処理にはある程度の時間を要するため、その期間の伝搬損の変動によっては最小伝搬損となる基地局が交代し、切り替え先の基地局へ干渉を与えてしまう場合がある。

【0003】上記した新しい基地局との接続処理の際に生ずる切り替え先の基地局への干渉について図9及び図10を参照して詳細に説明する。ここで、$T_c$は接続しきいレベルであり、$P_o$は基地局切り替え処理に要する時間であり、$C_r$は干渉を及ぼす期間を表す時間であり、$T_o$はソフトハンドオフ実施の際の従来方法での基地局接続しきいレベルであり、$T_1$はソフトハンドオフ実施の際の従来方法での基地局接続解除しきいレベルである。

【0004】基地局BS#Aに接続中の移動局が、基地局BS#Bのゾーンへ移行する場合を考える。基地局BS#Aと基地局BS#Bとの伝搬損の差がしきいレベルTよりも小さくなった時点で基地局切り替え処理を開始し、切り替え処理が終了するまでに要する時間を$P_o$とする。$P_o$時間の間、移動局は基地局BS#Aに対して送信電力制御を実行する。

【0005】図9に示すように接続処理時間$P_o$の間に基地局BS#Bの伝搬損が基地局BS#Aのそれより小さくなると、基地局BS#Aに対して送信電力制御を行っている移動局は、基地局BS#Aよりも伝搬損の小さい基地局BS#Bへ干渉を与えてしまう。すなわち、図9に示した$C_r$時間の間は基地局BS#Bへ干渉が及ぶ。

【0006】この接続処理に起因する干渉問題を克服する手法として、1991年5月、プロシーディング・イン・アイ・イー・イー・イー・ビーキュラー・テクノロ

ジー・カンファレンス、５７－６２項、米国（Ｐｒｏｃｅｅｄｉｎｇ ｉｎ ＩＥＥＥ Ｖｅｈｉｃｕｌａｒ Ｔｅｃｈｎｏｌｏｇｙ Ｃｏｎｆｅｒｅｎｃｅ，ｐｐ．５７－６２，Ｍａｙ，１９９１）に記載の手法が知られている。ソフトハンドオフと呼ばれる上記文献に記載の手法では最小伝搬損となる基地局を含む複数の基地局候補と同時接続して伝搬損の変動に備える手法を用いている。図１０にその様子を示した。

【０００７】図９と同様、基地局ＢＳ＃Ａに接続中の移動局が、基地局ＢＳ＃Ｂのゾーンへ移行する場合を考えている。基地局ＢＳ＃ＡとＢＳ＃Ｂとの伝搬損の差がしきいレベルＴ。よりも小さくなった時点で基地局ＢＳ＃Ａとの接続を保持しつつ、基地局ＢＳ＃Ｂとの接続を開始する。接続処理時間Ｐ。を経て基地局ＢＳ＃Ｂとの接続処理が完了すると、両方の基地局との接続が開始される。同時接続の期間は常に伝搬損の最も低い他の基地局に対する送信電力制御が実施されるために、図９で問題となった基地局ＢＳ＃Ｂへの干渉は問題とならない。その後、基地局ＢＳ＃ＡとＢＳ＃Ｂとの伝搬損の差がしきいレベルＴ１を超えた時点で基地局ＢＳ＃Ａとの接続を解除する。このように、伝播損レベルがひっ迫する複数の基地局と同時接続を行うことによって、最小伝搬損基地局の交代に対処でき、干渉を抑えることができる。

【０００８】新たな基地局との接続を開始する際のしきいレベルＴ。と接続を解除する際のしきいレベルＴ$_1$は、後者を大きく設定する。ヒステリシスマージンと呼ばれるＴ。とＴ$_1$の差は、基地局間の伝搬損の差がしきいレベル付近で激しく変化するような場合に、基地局接続解除切り替えが頻発するのを防止するために設けられている。基地局との接続を開始する際のしきいレベルＴ。ならびに接続を解除する際のしきいレベルＴ$_1$は、大きくすればするほど同時接続される基地局の数は増加する。

【０００９】

【発明が解決しようとする課題】しかしながら、移動局から各基地局までの伝搬損の変動の速度ならびに大きさは、移動局の移動速度や周辺の伝搬環境によって変化する。例えば建物等が密集する都市部では、電波伝搬経路を遮蔽する物体が多いため、わずかな距離を進んだだけでも伝搬損が大きく変化する。すなわち都市部では伝搬損の変動が速くて、しかも大きい。一方、郊外では伝搬経路を遮蔽する物体が少ないため、伝搬損の変動は緩慢で大きさも小さい。

【００１０】上記した従来の基地局選択法における伝搬損しきいレベルは、伝搬環境によらず常に一定のレベルとしている。しかし、都市などの伝搬損の変動が速い地域においては接続解除のための伝搬損しきいレベルを大きめに設定して伝搬損の急な変動に備えておく必要がある。さもないと、最小伝搬損となる基地局との接続が遅れてしまい、この基地局へ干渉を与えてしまう。一方、伝搬損変動の緩慢な郊外では、少数の基地局と接続すればよく、伝搬損しきいレベルを小さく設定することが可能である。すなわち、固定のパイロットしきいレベルでは、同時接続基地局の過不足が生じ効率的なシステムの運用が実現できない。

【００１１】また、伝搬損の変動が緩慢である場合、接続解除切り替えの頻発は起らないので、ヒステリシスマージンを小さく設定してもよい。むしろ不必要に大きなヒステリシスマージンを設定すると、無駄な基地局との接続を維持することとなりシステムの効率的な運用を妨げてしまう。

【００１２】本発明の目的は、ソフトハンドオフを実施する際の同時接続基地局の過不足を無くし、効率的なシステムの運用を実現することである。

【００１３】

【課題を解決するための手段】本発明の基地局選択法は、伝搬損の変動速度によって基地局選択しきいレベルならびにヒステリシスマージンを変化させることを特徴としている。

【００１４】伝搬員が高速に変動する場合は、基地局選択しきいレベルを大きくして多数の基地局との同時接続を行い、信頼性の高い基地局選択を実現する。なおかつ、ヒステリシスマージンを大きく設定して、基地局接続解除切り替えの頻発を防止する。一方、伝搬損の変動が緩慢である場合は基地局選択しきいレベルを小さくして少数の基地局との同時接続を行い効率化を図る。同時に、ヒステリシスマージンを小さく設定して無駄な基地局との接続を早めに解除する。

【００１５】本発明によれば、複数の基地局との接続が可能な移動局から前記基地局群までの伝搬損レベルの大小を比較することによって前記移動局が接続する基地局を選択し、前記移動局は同時に複数の基地局との通信が可能であり、前記移動局の移動に伴って接続する基地局を変更する符号分割多重セルラー移動通信システムの基地局選択方法において、前記複数の基地局に対する伝搬損のうち最小伝搬損となる基地局の伝搬損を基準として前記複数の基地局に対するそれぞれの相対伝搬損を把握するステップと、前記相対伝搬損の変動速度を求めるステップと、各基地局と前記移動局が接続中であるか否かを判定するステップと、前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられるしきい関数を下回る場合には、該当する非接続中の基地局との接続を開始しするステップを有することを特徴とする符号分割多重セルラー移動無線通信システムにおける基地局選択方法が得られる。

【００１６】さらに、本発明によれば、前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が前記しきい関数を上回る場合には、該当する非接続中の基地局との非接続状態を保持するステ

ップを有することを特徴とする符号分割多重セルラー移動無線通信システムにおける基地局選択方法が得られる。

【0017】さらに、本発明によれば、前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回れば、該当する接続中の基地局との接続を解除することを特徴とする符号分割多重セルラー移動無線通信システムにおける基地局選択方法が得られる。

【0018】さらに、本発明によれば、前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回らない場合には、該当する接続中の基地局との接続状態を保持するステップを有することを特徴とする符号分割多重セルラー移動無線通信システムにおける基地局選択方法が得られる。

【0019】さらに、本発明によれば、前記しきい関数は、前記相対伝搬損の変動速度を引数とする関数で与え、前記変動速度が速いほど大きな値となるように設定することを特徴とする符号分割多重セルラー移動無線通信システムにおける基地局選択方法が得られる。

【0020】さらに、本発明によれば、前記ヒステリシスマージンは、前記相対伝搬損の変動速度を引数とする関数で与え、前記変動速度が速いほど大きな値となるように設定することを特徴とする符号分割多重セルラー移動無線通信システムにおける基地局選択方法が得られる。

【0021】又、本発明によれば、複数の基地局との接続が可能な移動局から前記基地局群までの伝搬損レベルの大小を比較することによって前記移動局が接続する基地局を選択し、前記移動局は同時に複数の基地局との通信が可能であり、前記移動局の移動に伴って接続する基地局を変更する符号分割多重セルラー移動通信システムの基地局選択方法において、前記複数の基地局に対する伝搬損のうち最小伝搬損となる基地局の伝搬損を基準として前記複数の基地局に対するそれぞれの相対伝搬損を把握するステップと、前記相対伝搬損の変動速度を求めるステップと、各基地局と前記移動局が接続中であるか否かを判定するステップと、前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が、前記移動局の移動速度の関数として与えられるしきい関数を下回る場合には、該当する非接続中の基地局との接続を開始しするステップを有することを特徴とする符号分割多重セルラー移動無線通信システムにおける基地局選択方法が得られる。

【0022】さらに、本発明によれば、前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が前記しきい関数を上回る場合には、該当する非接続中の基地局との非接続状態を保持するステップを有することを特徴とする符号分割多重セルラー移動無線通信システムにおける基地局選択方法が得られる。

【0023】さらに、本発明によれば、前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回れば、該当する接続中の基地局との接続を解除することを特徴とする符号分割多重セルラー移動無線通信システムにおける基地局選択方法が得られる。

【0024】さらに、本発明によれば、前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回らない場合には、該当する接続中の基地局との接続状態を保持するステップを有することを特徴とする符号分割多重セルラー移動無線通信システムにおける基地局選択方法が得られる。

【0025】さらに、本発明によれば、前記しきい関数は、前記移動局の移動速度を引数とする関数で与え、前記移動速度が速いほど大きな値となるように設定することを特徴とする符号分割多重セルラー移動無線通信システムにおける基地局選択方法が得られる。

【0026】さらに、本発明によれば、前記ヒステリシスマージンは、前記移動局の移動速度を引数とする関数で与え、前記移動速度が速いほど大きな値となるように設定することを特徴とする符号分割多重セルラー移動無線通信システムにおける基地局選択方法が得られる。

【0027】又、本発明によれば、複数の基地局と少なくとも一つの移動局を含み、前記移動局から前記各基地局への伝搬損失を測定する伝搬損失測定装置と、前記伝搬損失測定装置に接続され、前記伝搬損レベルが高速に変動する場合、基地局との接続の開始、解除を決めるためのヒステリシスマージンを大きく設定し、前記伝搬損の変動が緩慢な場合、前記ヒステリシスマージンを小さく設定するソフトハンドオフ基地局選定装置を具備し、該ソフトハンドオフ基地局選定装置は、前記複数の基地局に対する伝搬損のうち最小伝搬損となる基地局の伝搬損を基準として前記複数の基地局に対するそれぞれの相対伝搬損を把握し、前記相対伝搬損の変動速度を求め、前記各基地局と前記移動局が接続中であるか否かを判定し、前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられるしきい関数を下回る場合には、該当する非接続中の基地局との接続を開始することを特徴とする符号分割多重セルラー移動無線通信システムが得られる。

【0028】さらに、本発明によれば、前記しきい関数は、前記相対伝搬損の変動速度を引数とする関数で与

え、前記変動速度が速いほど大きな値となるように設定することを特徴とする符号分割多重セルラー移動無線通信システムが得られる。

【0029】さらに、本発明によれば、前記ソフトハンドオフ基地局選定装置は、前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が前記しきい関数を上回る場合には、該当する非接続中の基地局との非接続状態を保持することを特徴とする符号分割多重セルラー移動無線通信システムが得られる。

【0030】さらに、本発明によれば、前記ソフトハンドオフ基地局選定装置は、前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回れば、該当する接続中の基地局との接続を解除することを特徴とする符号分割多重セルラー移動無線通信システムが得られる。

【0031】さらに、本発明によれば、前記ソフトハンドオフ基地局選定装置は、前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回らない場合には、該当する接続中の基地局との接続状態を保持することを特徴とする符号分割多重セルラー移動無線通信システムが得られる。

【0032】又、本発明によれば、複数の基地局と少なくとも一つの移動局を含み、前記移動局から前記各基地局への伝搬損失を測定する伝搬損失測定装置と、前記移動局の移動速度を検出する移動速度検出装置と、前記伝搬損失測定装置及び前記移動速度検出装置に接続され、前記移動速度が速い場合、基地局との接続の開始、解除を決めるためのヒステリシスマージンを大きく設定し、前記移動速度が遅い場合、前記ヒステリシスマージンを小さく設定するソフトハンドオフ基地局選定装置を具備し、該ソフトハンドオフ基地局選定装置は、前記複数の基地局に対する伝搬損のうち最小伝搬損となる基地局の伝搬損を基準として前記複数の基地局に対するそれぞれの相対伝搬損を把握し、前記相対伝搬損の変動速度を求め、前記各基地局と前記移動局が接続中であるか否かを判定し、前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が、前記移動速度の関数として与えられるしきい関数を下回る場合には、該当する非接続中の基地局との接続を開始することを特徴とする符号分割多重セルラー移動無線通信システムが得られる。

【0033】さらに、本発明によれば、前記しきい関数は、前記移動速度を引数とする関数で与え、前記移動速度が速いほど大きな値となるように設定することを特徴とする符号分割多重セルラー移動無線通信システムが得られる。

【0034】さらに、本発明によれば、前記ソフトハンドオフ基地局選定装置は、前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が前記しきい関数を上回る場合には、該当する非接続中の基地局との非接続状態を保持することを特徴とする符号分割多重セルラー移動無線通信システムが得られる。

【0035】さらに、本発明によれば、前記ソフトハンドオフ基地局選定装置は、前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回れば、該当する接続中の基地局との接続を解除することを特徴とする符号分割多重セルラー移動無線通信システムが得られる。

【0036】さらに、本発明によれば、前記ソフトハンドオフ基地局選定装置は、前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回らない場合には、該当する接続中の基地局との接続状態を保持することを特徴とする符号分割多重セルラー移動無線通信システムが得られる。

【0037】又、本発明によれば、移動局から各基地局への伝搬損失を測定する伝搬損失測定装置と、前記伝搬損失測定装置に接続され、前記伝搬損レベルが高速に変動する場合、基地局との接続の開始、解除を決めるためのヒステリシスマージンを大きく設定し、前記伝搬損の変動が緩慢な場合、前記ヒステリシスマージンを小さく設定するソフトハンドオフ基地局選定装置を具備し、該ソフトハンドオフ基地局選定装置は、前記複数の基地局に対する伝搬損のうち最小伝搬損となる基地局の伝搬損を基準として前記複数の基地局に対するそれぞれの相対伝搬損を把握し、前記相対伝搬損の変動速度を求め、前記各基地局と前記移動局が接続中であるか否かを判定し、前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられるしきい関数を下回る場合には、該当する非接続中の基地局との接続を開始することを特徴とする移動局装置が得られる。

【0038】さらに、本発明によれば、前記しきい関数は、前記相対伝搬損の変動速度を引数とする関数で与え、前記変動速度が速いほど大きな値となるように設定することを特徴とする移動局装置が得られる。

【0039】さらに、本発明によれば、前記ソフトハンドオフ基地局選定装置は、前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が前記しきい関数を上回る場合には、該当する非接続中の基地局との非接続状態を保持することを特徴とする移動局装置が得られる。

【0040】さらに、本発明によれば、前記ソフトハン

ドオフ基地局選定装置は、前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回れば、該当する接続中の基地局との接続を解除することを特徴とする移動局装置が得られる。

【0041】さらに、本発明によれば、前記ソフトハンドオフ基地局選定装置は、前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回らない場合には、該当する接続中の基地局との接続状態を保持することを特徴とする移動局装置が得られる。

【0042】又、本発明によれば、移動局から各基地局への伝搬損失を測定する伝搬損失測定装置と、前記移動局の移動速度を検出する移動速度検出装置と、前記伝搬損失測定装置及び前記移動速度検出装置に接続され、前記移動速度が速い場合、基地局との接続の開始、解除を決めるためのヒステリシスマージンを大きく設定し、前記移動速度が遅い場合、前記ヒステリシスマージンを小さく設定するソフトハンドオフ基地局選定装置を具備し、該ソフトハンドオフ基地局選定装置は、前記複数の基地局に対する伝搬損のうち最小伝搬損となる基地局の伝搬損を基準として前記複数の基地局に対するそれぞれの相対伝搬損を把握し、前記相対伝搬損の変動速度を求め、前記各基地局と前記移動局が接続中であるか否かを判定し、前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が、前記移動速度の関数として与えられるしきい関数を下回る場合には、該当する非接続中の基地局との接続を開始することを特徴とする移動局装置が得られる。

【0043】さらに、本発明によれば、前記しきい関数は、前記移動速度を引数とする関数で与え、前記移動速度が速いほど大きな値となるように設定することを特徴とする移動局装置が得られる。

【0044】さらに、本発明によれば、前記ソフトハンドオフ基地局選定装置は、前記判定の結果、非接続中でかつ該当する非接続中の基地局に対する前記相対伝搬損が前記しきい関数を上回る場合には、該当する非接続中の基地局との非接続状態を保持することを特徴とする移動局装置が得られる。

【0045】さらに、本発明によれば、前記ソフトハンドオフ基地局選定装置は、前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回れば、該当する接続中の基地局との接続を解除することを特徴とする移動局装置が得られる。

【0046】さらに、本発明によれば、前記ソフトハンドオフ基地局選定装置は、前記判定の結果、接続中でかつ該当する接続中の基地局に対する前記相対伝搬損が、前記変動速度の関数として与えられる前記しきい関数にヒステリシスマージンを加えたレベルを上回らない場合には、該当する接続中の基地局との接続状態を保持することを特徴とする移動局装置が得られる。



【0047】

【発明の実施の形態】以下、本発明の一実施の形態について図面を参照して詳細に説明する。図1は符号分割多重セルラー移動無線通信システムのソフトハンドオフにおける接続状態を示す図である。図2ならびに図3は本発明の実施の形態における移動局13を構成する移動局装置ならびにに基地局12-1，12-2を構成する基地局装置をそれぞれ示したものである。

【0048】まず、図2に示した移動局装置の動作について説明する。基地局より放出された送信信号は送受共用装置21において受信され、RF部22を経た後、移動速度検出装置23ならびに伝搬損測定装置24に入力される。移動速度検出装置23では、該移動局自身の移動速度Vmsが出力され、一方、伝搬損失測定装置24においては該移動局の近隣に位置する複数の基地局、それぞれとの伝搬損失$L_{i(t)}$[dB]が見積もられる。ここで、iは0～Nの整数で与えられる基地局インデックスを、またtは測定時刻を表す。なお、前記複数基地局までの伝搬損失は、例えば、各基地局が放出するパイロット信号の受信強度ならびにパイロット信号の送信出力により概算される。移動速度Vms、伝搬損失$L_{i(t)}$は、ソフトハンドオフ基地局選定装置BSSへ入力され、新たにソフトハンドオフ対象となる基地局もしくは接続を解除する基地局を決定する。新たなソフトハンドオフ対象基地局もしくは接続を解除する基地局の決定結果は、接続解除変数$BS_{info.i}$として与えられる。$BS_{info.i}=1$は該当する基地局iとの接続要求を意味し、$BS_{info.i}=-1$は該当する基地局iとの接続解除を意味し、さらに$BS_{info.i}=0$は現接続状態を保持することを意味する。ソフトハンドオフ基地局選定装置BSSにより決定された接続解除変数$BS_{info.i}$は制御信号生成装置31へ入力され、接続もしくは解除を要求される基地局群へその旨の制御信号を生成する。制御信号生成装置31の出力ならびに送信情報26は結合装置25において結合され、オーバーヘッド挿入部30において各種付加情報が挿入される。オーバーヘッド挿入部30の出力信号は、拡散器29、変調器28、増幅装置27を通過した後、送受共用装置21によって基地局へ向けて放出される。

【0049】次に、図3に示した基地局装置の動作について説明する。移動局13より放出された送信信号は送受共用装置41を通過した後、RF部42、復調器43を経て復調される。復調器43の出力に含まれる制御信号は制御信号検出装置44において検出される。検出された制御信号は交換局11へ伝達され、交換局11にお

いては制御信号に含まれる基地局接続指令もしくは基地局接続解除指令に基づいて該当する基地局の接続、解除処理が実施される。

【0050】次に、図2に示したソフトハンドオフ基地局選定装置BSSの動作の一実施の形態を図4に示す。図4の実施の形態では、移動局と基地局iとの伝搬損失$L_{i(t)}$[dB]より伝搬損変動速度を求め、これにより接続解除しきいレベルを決定している。

【0051】まず、ステップ100において基地局iとの伝搬損失$L_{i(t)}$[dB]のうち最小値を$L_{min(t)}$[dB]と定義する。次にステップ101において、基地局番号を表すループ変数kに0を設定する。ステップ102において、基地局kとの伝搬損失$L_{k(t)}$[dB]から$L_{min(t)}$[dB]を差し引いて、相対伝搬損レベル$L_{n,k}$[dB]を得る。ステップ103において、$L_{n,k(t)}$の微分値の絶対値[$L_{n,k(t)}$]を計算する。ステップ104において、基地局kと移動局が通話中であるか無いかを判定し、通話中であればステップ105へ、通話中でなければステップ106へ進む。

【0052】ステップ104において、速度の関数として定義される解除しきいレベル$T_r$の値を計算し、$T_r$(|$L_{n,k(t)}$|)が$L_{n,k(t)}$よりも小さければステップ107へ、そうでなければステップ108へ進む。一方、ステップ106において、速度の関数として定義される接続しきいレベル$T_a$の値を計算し、$T_a$(|$L_{n,k(t)}$|)が$L_{n,k(t)}$よりも大きければステップ109へ進み、そうでなければステップ108へ進む。ステップ107においては、基地局kとの接続解除を意味する接続解除変数$BS_{info,k}=-1$を設定し、ステップ109においては基地局kとの接続を意味する接続解除変数$BS_{info,k}=1$を設定する。ステップ108においては、基地局kとの接続状態を保持するように接続解除変数$BS_{info,k}=0$を設定する。ステップ107～109の後は、ステップ110へ進み、ループ変数kが基地局数Nを超えているかどうかが判定される。k<Nであれば、ステップ111においてkに1を加えた後、ステップ102へ戻る。kがN以上であれば、接続解除変数$BS_{info,i}$を図2に示した制御信号生成装置31へ向けて出力する。

【0053】なお、移動速度検出装置23で検出された該移動局自身の移動速度Vmsは、本実施の形態では使用されずステップ102において終端する。

【0054】図5は、接続しきいレベル関数$T_a$ならびに解除しきいレベル関数$T_r$の一例を示したものである。$T_a$, $T_r$とも、$L_{n,i(t)}$の変動速度の大きさを表す|$L_{n,i(t)}$|が大きくなるほど大きくなるように設定する。また、解除しきいレベル$T_r$は$T_a$よりもヒステリシスマージン分だけ高くなるように設定し、かつヒステリシスマージンは|$L_{n,i(t)}$|が大きいほど大きくする。図4に示した流れ図による基地局iの接続処理ならびに解除処理は、図5を用いて次のように説明できる。

【0055】基地局iが接続中でない場合、点(|$L_{n,i(t)}$|, $L_{n,i(t)}$)を図5上に点描し、この点が接続しきいレベル$T_a$よりも下部に位置する場合にこの基地局は接続基地局として選択される。一方、基地局iがすでに接続中である場合、点(|$L_{n,i(t)}$|, $L_{n,i(t)}$)を図2上に点描し、この点が解除しきいレベル$T_r$よりも上部に位置する場合にこの基地局との接続を解除する。それ以外の場合は、現接続状態を保つ。

【0056】次に、図5に示した$T_a$, $T_r$を適用した場合の基地局選択から解除までの一例について述べる。図6に、縦軸を$L_{n,i(t)}$、横軸を|$L_{n,i(t)}$|とするグラフ上に点描される点(|$L_{n,i(t)}$|対$L_{n,i(t)}$)の軌跡を曲線で示した。点(|$L_{n,i(t)}$|の|$L_{n,i(t)}$|)は時間の経過に伴って図6中に示した矢印の方向に推移する。

【0057】点(|$L_{n,i(t)}$|, $L_{n,i(t)}$)が時点a, すなわち基地局選択しきいレベル$T_a$を下回った時点で基地局iとの接続処理を開始する。接続処理を経て、時点bより基地局iとの接続が開始される。その後、時点c、すなわち解除しきいレベル$T_r$を上回った時点で、基地局iとの接続を直ちに解除する。結局、時点bから時点cまでの期間、基地局iとの通信が行われる。

【0058】以下本発明の他の実施の形態について図面を参照して説明する。

【0059】図8は図2に示したソフトハンドオフ基地局選定装置BSSの他の実施の形態を示したものである。伝搬損の変動速度は端末の移動速度に比例する事実より、図8の実施の形態では、移動速度検出装置23で検出された移動局自身の移動速度Vmsにより接続解除しきいレベルを決定している。

【0060】まず、ステップ200において基地局iと該移動局の伝搬損失$L_{i(t)}$[dB]のうちの最小値を$L_{min(t)}$[dB]と定義する。次にステップ201において、基地局番号を表すループ変数kに0を設定する。ステップ202において、基地局kとの伝搬損失$L_{k(t)}$[dB]から$L_{min(t)}$[dB]を差し引いて、相対伝搬損レベル$L_{n,k}$[dB]を得る。ステップ203において、基地局kと移動局が通話中であるか無いかを判定し、通話中であればステップ204へ、通話中でなければステップ205へ進む。

【0061】ステップ204へは移動速度検出装置23で検出された該移動局自身の移動速度Vmsが入力され、速度の関数として定義される解除しきいレベル$T_r$の値を計算し、$T_r$(Vms)が$L_{n,k(t)}$よりも小さければステップ206へ、そうでなければステップ207へ進む。一方、ステップ205において、速度の関数として定義される接続しきいレベル$T_a$の値を計算し、T

，（Vms）が$L_{n,k(t)}$よりも大きければステップ２０８へ進み、そうでなければステップ２０７へ進む。ステップ２０６においては、基地局ｋとの接続解除を意味する接続解除変数$BS_{info,k}$＝－１を設定し、ステップ２０８においては基地局ｋとの接続を意味する接続解除変数$BS_{info,k}$＝１を設定する。ステップ２０７においては、基地局ｋとの接続状態を保持するように接続解除変数$BS_{info,k}$＝０を設定する。ステップ２０６～２０８の後は、ステップ２０９へ進み、ループ変数ｋが基地局数Ｎを超えているかどうかが判定される。ｋ＜Ｎであれば、ステップ２１０においてｋに１を加えた後、ステップ２０２へ戻る。ｋ＞が＝Ｎ以上であれば、接続解除変数$BS_{info,i}$を図２に示した制御信号精製装置３１へ向けて出力する。

【００６２】伝搬損の変動速度は、端末の移動速度に比例する。図８に示した実施形態は、伝搬損の変動速度を端末の移動速度から間接的に推定する手法である。図４に示した実施の形態においては、伝搬損の推定結果を微分することで直接的に伝搬損の変動速度を検出した。図４の場合、伝搬損の推定結果に誤差成分が含まれると、伝搬損推定誤差が変動速度推定値へ伝搬してしまい、変動速度推定値にも誤差が生じる問題がある。これに対して、図８に示した実施の形態によると、伝搬損推定誤差と伝搬損変動速度誤差が分けられるために、誤差の伝搬が回避できる。

【００６３】

【発明の効果】以上説明したように、本発明によれば、伝搬損の変動速度によって基地局選択しきいレベルならびにヒステリシスマージンを変化させることによって、伝搬環境や移動局の移動速度に応じた適正な数の基地局との通信が可能となり、効率的かつ信頼性の高い基地局選択が実現できる。

【図面の簡単な説明】

【図１】符号分割多重セルラー移動無線通信システムのソフトハンドオフにおける接続状態を示す図である。

【図２】本発明の移動局装置の構成を示す図である。

【図３】本発明の基地局装置の構成を示す図である。

【図４】本発明の基地局選択方法の各ステップを示した流れ図である。

【図５】基地局接続ならびに解除のためのしきいレベルの一例を示す図である。

【図６】基地局接続から解除までの一例を示す図である。



【図７】移動局の移動速度に対するセル境界付近における平均同時接続基地局を示す図である。

【図８】本発明の他の基地局選択方法の各ステップを示した流れ図である。

【図９】従来技術においてソフトハンドオフを実施しない場合の伝搬損変動に対する基地局切り替え過程を示す図である。

【図１０】従来技術においてソフトハンドオフを実施する場合の伝搬損変動する基地局切り替え過程を示す図である。

【符号の説明】

$L_{min(t)}$　最小伝搬損測定レベル

$L_{n,i(t)}$　最小伝搬損測定レベルを差し引いた相対伝搬損測定レベル

Ｔ。　接続しきいレベル関数

Ｔ，　解除しきいレベル関数

ａ　基地局接続処理開始時点

ｂ　基地局接続開始時点

ｃ　基地局接続解除時点

ＢＳ＃Ａ　接続元基地局

ＢＳ＃Ｂ　接続先基地局

ＢＳＳ　ソフトハンドオフ基地局選定装置

１１　交換局

１２－１，１２－２　基地局

１３　移動局

１６－１　基地局１２－１との接続領域

１６－２　基地局１２－２との接続領域

２１　送受共用装置

２２　ＲＦ部

２３　移動速度検出装置

２４　伝搬損失測定装置

２５　結合装置

２６　送信情報

２７　増幅装置

２８　変調器

２９　拡散器

３０　オーバーヘッド挿入部

３１　制御信号生成装置

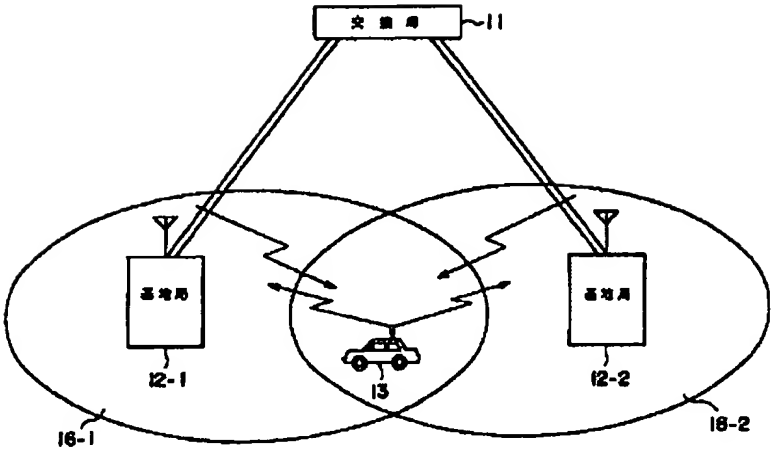
４１　送受共用装置

４２　ＲＦ部

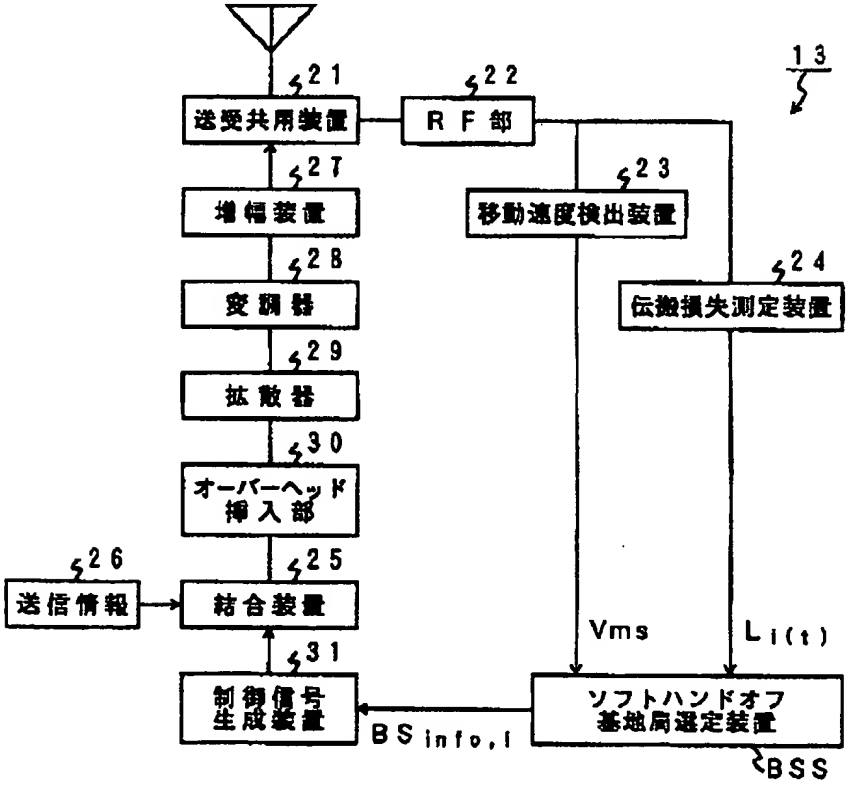
４３　復調器

４４　制御信号検出装置

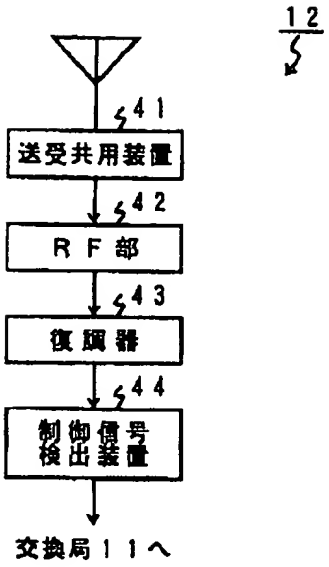
【図1】


交換局
11
基地局
12-1
基地局
12-2
13
16-1
16-2

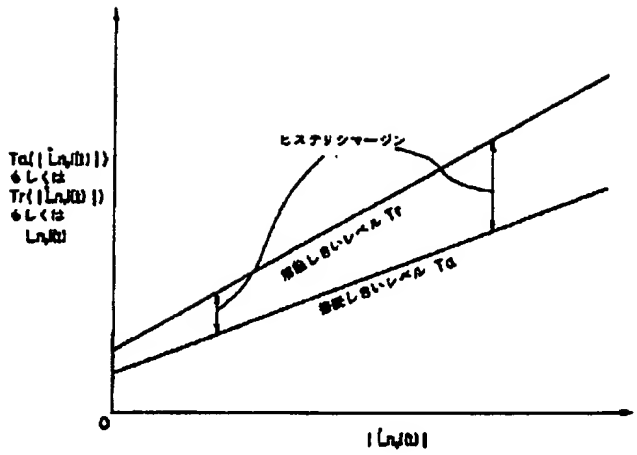
【図2】


21
送受共用装置
22
RF部
13
27
増幅装置
23
移動速度検出装置
28
変調器
24
伝搬損失測定装置
29
拡散器
30
オーバーヘッド挿入部
26
送信情報
25
結合装置
Vms
Li(t)
31
制御信号生成装置
BSinfo,i
ソフトハンドオフ基地局選定装置
BSS

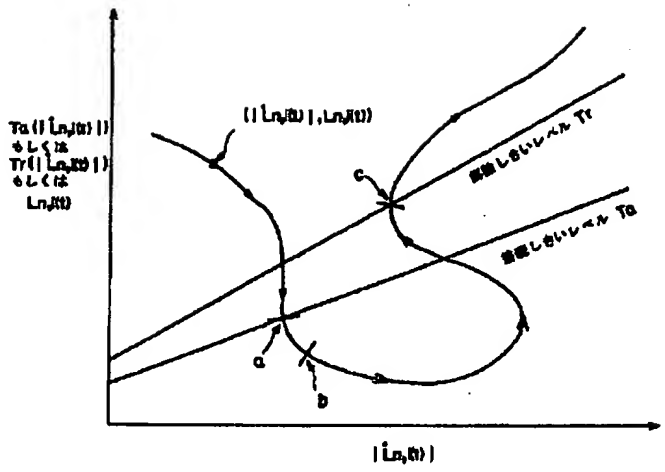
【図３】


12
41
送受共用装置
42
ＲＦ部
43
復調器
44
制御信号検出装置
交換局１１へ

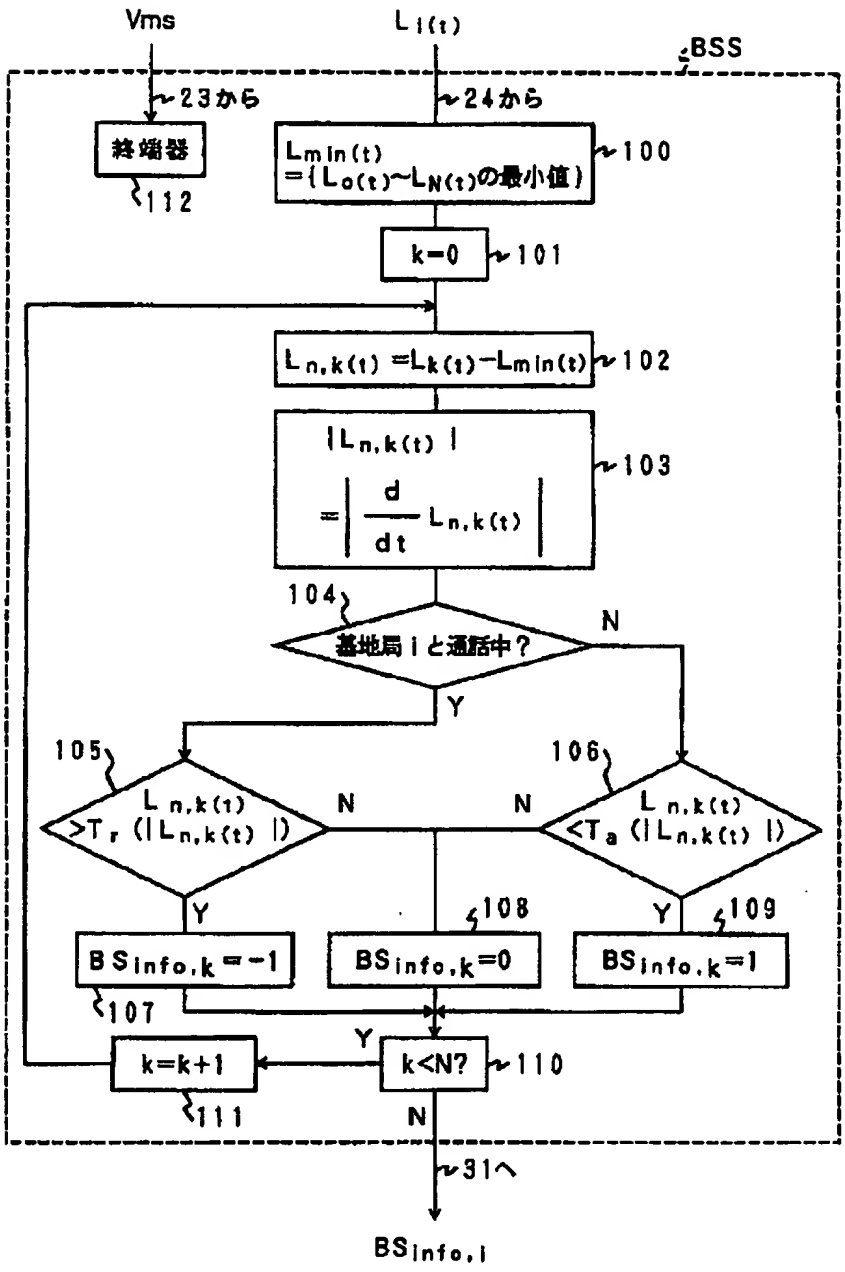
【図５】


ヒステリシマージン
動作しないレベル Tr
復帰しないレベル Ta
0

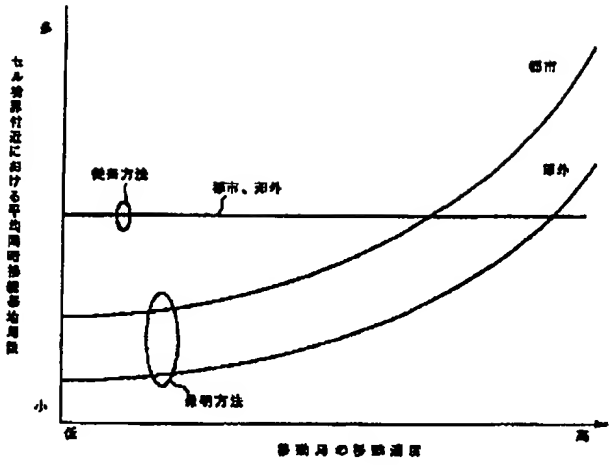
【図６】


C
動作しないレベル Tr
復帰しないレベル Ta
a
b

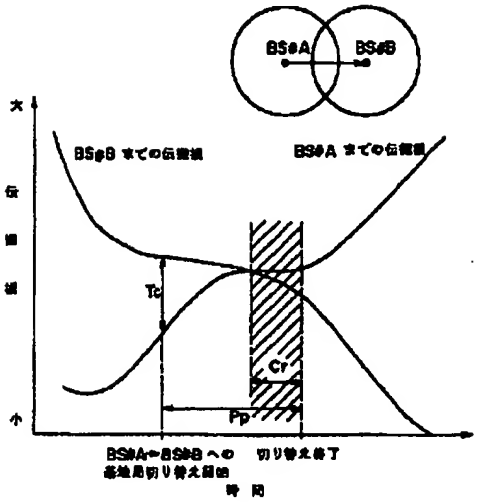
【図4】


Vms
$L_{I(t)}$
BSS
23から
24から
終端器
112
$L_{min(t)}$ $=\{L_{0(t)}\sim L_{N(t)}$の最小値$\}$
100
k=0
101
$L_{n,k(t)}=L_{k(t)}-L_{min(t)}$
102
$|L_{n,k(t)}|$ $=\left|\frac{d}{dt}L_{n,k(t)}\right|$
103
104
基地局Iと通話中？
N
Y
105
$L_{n,k(t)}$ $>T_r(|L_{n,k(t)}|)$
106
$L_{n,k(t)}$ $<T_a(|L_{n,k(t)}|)$
N
N
Y
Y
108
109
$BS_{info,k}=-1$
$BS_{info,k}=0$
$BS_{info,k}=1$
107
Y
k=k+1
111
k<N?
110
N
31へ
$BS_{info,I}$

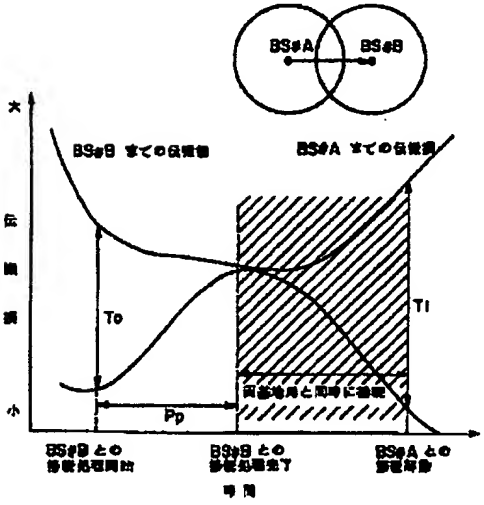
【図７】



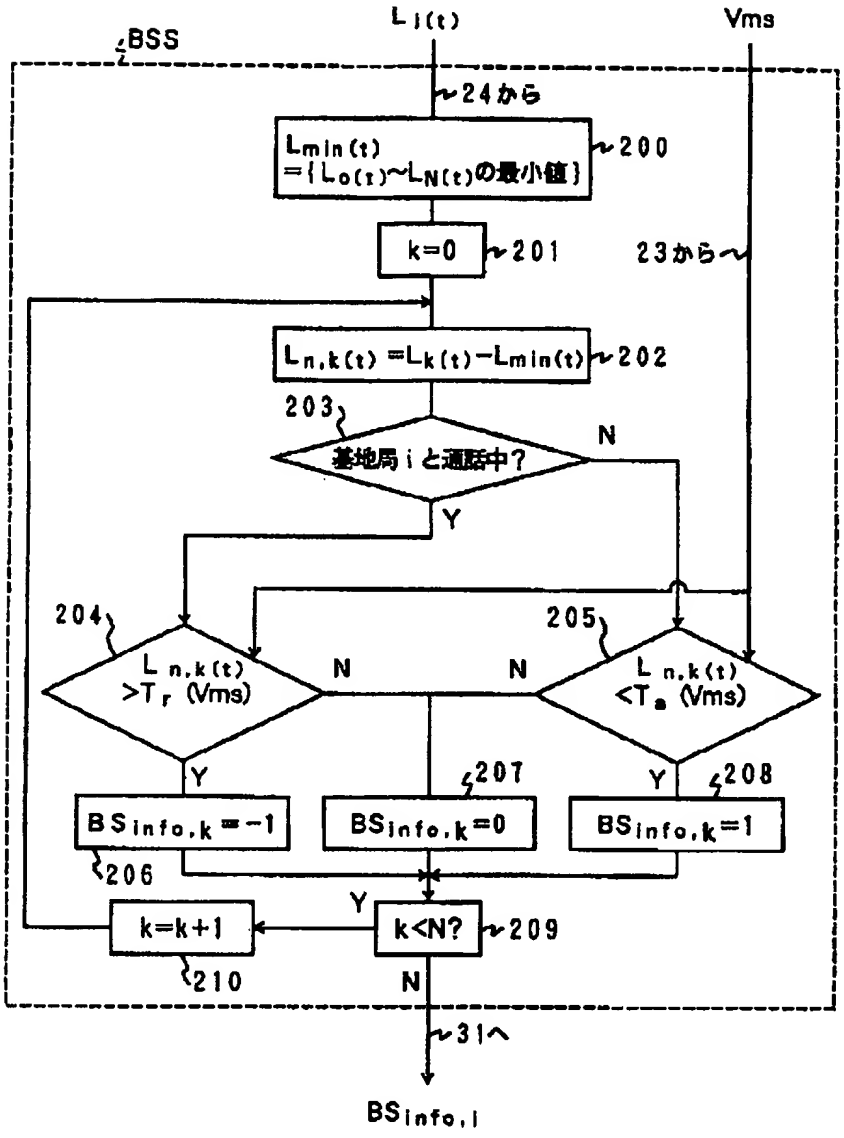

【図９】




【図１０】



【図8】


BSS
$L_{i(t)}$
Vms
24から
$L_{min(t)}$ ={$L_{0(t)}$～$L_{N(t)}$の最小値}
200
k=0
201
23から
$L_{n,k(t)}$ =$L_{k(t)}$−$L_{min(t)}$
202
203
基地局iと通話中?
N
Y
204
$L_{n,k(t)}$ >$T_r$ (Vms)
205
$L_{n,k(t)}$ <$T_a$ (Vms)
N
N
Y
207
Y
208
$BS_{info,k}$=−1
$BS_{info,k}$=0
$BS_{info,k}$=1
206
Y
k=k+1
k<N?
209
210
N
31へ
$BS_{info,i}$